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Can You Afford That Asset?

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Here described, with comprehensive review of considerations involved in recognizing the need for and of evaluating capital outlays—including a discussion of six approaches currently in use—is a plan which subjects proposals to a detailed study of income and costs for advantages and disadvantages. The comparison aimed at is between present and prospective profitability of capital employed. The paper is illustrated with forms which directly underlie the plan. Professor Beaudry has been awarded the 1953-54 Lybrand Gold Medal for this manuscript.

CAN YOU AFFORD THAT ASSET? Or, perhaps, Mr. Executive, can you afford not to buy it? Do you know enough about it to decide? Being able to afford a new car or a new television set as a family investment is very different from determining whether a company can afford to buy a new production machine or building. But what are the things an executive should know about an asset before he can decide whether the company can afford it and where the answers are to be found? Most executives are accustomed to talking in vague generalities, such as: "Do we have the cash?" "Will it be profitable?" "How long will it take to pay for itself?" There is a better way.

Joel Dean opens his book, *Capital Budgeting*, with these important phrases:

> "Making decisions on capital expenditures is one of the most demanding responsibilities of top management. There are few guideposts for determining either the amount or the kind of investments to make. Without such guides, decisions are made on the bases of ill-defined standards and intuitive judgment. There is a need for an analytical framework that will systematize management's approach to this problem."[1]

1. Dean, Joel, *Capital Budgeting*, Columbia University Press, N.Y., 1951, p. 1.

As Dean suggests, professional literature offers little help in evaluating criteria or presenting programs to help organize available information on capital expenditures. Engineering economy studies have dealt with the problem of equipment project analysis but have been concerned principally with the direct production aspects and have omitted from consideration many of the cost elements which the accountant recognizes as extremely important. The present paper attempts to establish what "afford" means practically to the executive. It presents a plan which both indicates whether a specific asset can be afforded and furnishes the forms which can be used to organize the capital allocation.

Some Factors Which Necessarily Influence Asset Purchases

The purchase of an asset must, first of all, fit into a company program. It is a long-term commitment. Hence, errors cannot be easily corrected. It must be right. It is, therefore, in most cases, a part of the capital budget. The capital budget is likely to be in three parts: the long-term over-all budget, the intermediate-term budget, and the current section for assets to be purchased during the present or immediately succeeding operating period. It is obvious that the asset must move forward in the capital budget until it becomes a reality but our concern is: how did it get there, and why?

Any asset is a part of the progress the firm expects to make. The company must have certain goals profit-wise and industry-wise. A great deal will depend upon the general conditions and stability of the industry in general and the maturity and influence of the firm in that industry. The extent to which the firm is an industry leader may have important implications for the purchase of new assets and the extent to which innovations are a part of the company's very life's blood. The general reputation for elegance, employee relations, engineering precision, or distinctive streamlining which the firm has created may dictate asset purchases which other firms might not be able to justify. Every asset purchased must be tied into the over-all program of progress which the company has set before itself.

The minimum that the proposed asset must produce is an amount which will maintain the integrity of the capital. It must be possible to recover in prices charged for the product produced by the asset during its life the total amount of the investment plus all other costs incurred. As this recovery is taking place, gradual reinvestment must be made to sustain the productivity. This normally does not mean simply replacement in kind. In a progressive industry, the reinvestment must be in new methods, new processes and modernized plants. During a period of inflation, it is necessary to increase capital productivity unless prices

of the product can be advanced as rapidly as the price level increases, in order even to maintain the integrity of the stockholders' capital. Therefore, most asset purchases must indicate greater productivity than the average of the assets now being employed or, in other terms, more than the present average profit rate on invested capital.

Needless to say, the purchase of an asset must be properly timed, independently of other considerations. It should be purchased at the proper time in the business cycle (preferably at the low-cost point). However, the timing may, in actual fact, be predominantly influenced by the availability of liquid resources. It is apparently true that most small and medium-sized firms are forced to purchase assets at times which are not the most desirable in the business cycle, because they do not have accumulations of past profits available or the necessary credit or nerve or a long-range plan to take advantage of conditions of low cyclical costs. The general business optimism which goes along with periods of high profit seems to stimulate asset purchases in spite of relatively high cost. However, there is probably no practical alternative to this lack of business cycle coordination in asset purchases for the small and medium-sized company.

Seeking a Capital Outlay Pattern Which Reflects Proper Balance

Balance is the keynote of effectiveness of any asset purchase program. In order to establish balance and maximize profitability for the firm, it is necessary to equate the marginal productivity of capital in its various uses. In less complex terms, this may be stated as the condition in which each one of the items added must produce at least as much as the other items are producing which the company already has. This profitability balance is not the only type of balance required, however. It is necessary to balance liquid assets and fixed asset proportions in a workable combination. Perhaps, the most difficult area in which to determine and establish balance is between the assets used to produce intangibles, such as, safety, morale, and better working conditions and the assets used to produce profitable products directly.

The actual pattern of asset purchase which any company has, will depend upon many of the general problems discussed in this paper and also the specific characteristics of the industry and the individual company. However, financial management should know what the asset purchase pattern has been and, in general, what it should be, for the company to maintain the appropriate balance. A building material manufacturing company[2] for the first four post-war years invested in assets in the following proportions:

2. *Ibid.*, p. 86.

New and improved products	27%
Expansion	24
Cost reduction	24
Replacement	18
Morale	7
	100%

This company felt that its normal program of asset purchases should call for: 40 per cent to 50 per cent to be invested in cost reduction and replacements, 40 per cent in new and improved products, and 10 per cent in welfare projects.

A valve and pipe fitting manufacturer for the seven year post-war period of 1946 to 1952, purchased assets which described the following pattern:

Replacement for production	33%
Expansion for production	27
Service, shops, inspection, and salvage	9
Furniture and office equipment	3
Buildings and grounds	16
Morale and employee services	12
	100%

As indicated at the start, the heart of the problem under study is, what does "afford" mean practically to the comptroller or financial executive. It is impossible to answer this completely and in detail. It varies for each firm. In general, there are at least six matters which must be considered. In the first place, the anticipated additional profit to be expected from the asset purchase must be determined, unless it has no direct profit producing abilities, such as assets used for morale-building purposes or employee services. Secondly, it must provide for working capital recovery. In other words, it must be an asset which will bring back into the firm working capital, in due time, so that the liquid position will not be dangerously depleted before the asset begins to restore the amount it has used up. Thirdly, the firm must have liquid capital available or must know how it can get it, either through bank loans or perhaps more elaborate financing. And, fourth, there is the question of whether or not the break-even point can stand the outlay. This is not meant in its most complex sense but, essentially, whether the purchase of the asset will make the production flow too inflexible. The fact is that the purchase of an expensive special purpose asset may cause production to become extremely rigid. If this is the prospect, it must then be asked: will high fixed charges lead to attempts to find ways to keep the machine operating?

This leads to the fifth point. What will happen to the sales-mix because of the purchase of this asset? Will it require a new sales-mix to employ it properly? After the asset has been purchased and put into operation, is it going to

be necessary to change the volume of sales in certain items to be able to use it at anything like its profitable capacity? This important question is often overlooked or inadequately evaluated by the engineering department in making asset proposals. The sixth point is that there are many nonprofit advantages which must be balanced against profitability elsewhere, when it comes to expenditures for assets used to improve working conditions, improve morale, etc.

Current Approaches: "Hunch," Pay-off, and Rate-of-Return

To become more specific about determining whether an asset can be afforded, several alternative approaches to evaluating anticipated profitability should be considered. It is obvious, in studying the very limited literature on capital expenditure allocations, that the greater part of industry, especially as represented by the small and medium-sized firms, uses the intuitive or "hunch" type of system, supplemented by random and poorly-organized cost studies of alternatives. In many cases this approach may be dignified by those by whom it is employed, by the suggestion that the selection is based on "sound business judgment" or "expert opinion." However, it appears to be rather general practice for the responsible executives to make the decisions on asset commitments on the basis of very limited specific knowledge and without a reasonable framework for organizing such information as is available. Intuition and familiarity with similar assets in use play the dominant role in determining asset expenditure allocations in industry today, with the exception of the large, well-staffed national companies. Needless to say, this method has nothing to recommend it except its short-run low initial cost, which may be far overbalanced by one costly mistake that a more scientific method would not have permitted.

A second common type of approach to fixed asset proposal evaluation is the "short-pay-off method." This is strictly a rule-of-thumb method with no scientific basis, although it is widely used. The short pay-off method of determining the desirability of asset purchases has many variations, with different degrees of refinement. George Terborgh, in his Appendix to Chapter XII of *Dynamic Equipment Policy*[3] defines ten different ways of computing the short pay-off requirement and discusses their shortcomings. However, the usual interpretation of the short pay-off requirement is that the new equipment must "pay for itself" in cost savings over a short period, such as two or three years. It is considered by many as being a very conservative method. This conclusion may be appro-

3. Terborgh, George, *Dynamic Equipment Policy,* McGraw-Hill Book Co., Inc., New York, 1949.

Form EAR-1

E-Number_____
Type_____
Dept._____
Date_____

EQUIPMENT ANALYSIS REPORT

Replacement and Service Facilities

New Equipment_____

Description of New Equipment_____

Manufacturer_____
Estimated Installed Cost $_____; Est. Life_____; Yearly Depr. $_____
Est. Salvage Value $_____; Other Equipment Required_____
Old Equipment_____

Description of Old Equipment_____

Machine Number_____; Installed Cost $_____; Salvage Value $_____
General Condition_____; Age_____; Remaining Book Value $_____

SUMMARY

Estimated Installed Cost of New Equipment $_____
Estimated Advantage Next Year (After Taxes) $_____
Percent of net yield on Capital Expenditure _____%

Evaluation of intangibles (Better Product -- Safety -- Better Working Conditions -- Smoother Flow of Product -- Etc.)_____

Comments_____

Priority Rating based on New Yield and Intangibles_____

EXHIBIT 1 (Part 1)

priate for the purchase of equipment for a new product or process, but it does not hold for replacements or re-equipment problems. In the case of replacements, as Terborgh points out, this method shields old equipment far beyond its useful economic life by requiring too great a net income to be indicated before replacements are made.

In fact, it may be said that, if the equipment engineer finds himself able to talk of number of years pay-off in terms which will interest financial management when considering replacement of assets, this suggests three posibilities as to the existing situation: (1) the plant is hopelessly obsolete, (2) the engineer is looking at the future with different colored glasses—much rosier—than the comptroller, or (3) he has not included all the necessary and pertinent figures. It is usually a combination of the last two. To be blunt about it, the short pay-off period required seldom is other than purely arbitrary and bears no economic relationship to the expected actual use period of the asset. There is no criterion

ESTIMATED OPERATIONAL ADVANTAGES

Annual Average over Entire Life	Old Equipment Advantage	New Equipment Advantage
INCOME ADVANTAGES (At Plant Level)*		
Increased Output (Actually Saleable)		
Superior Product		
Other		
OPERATING COST ADVANTAGES		
Direct labor		
Indirect Labor		
Set-up time		
Overtime and shop premiums		
Payroll taxes and workman's compensation #		
Power comsumption		
Gas and water		
Maintenance and repairs		
Tool costs		
Supplies		
Spoilage -- Scrap		
Defective output -- Rework		
Downtime		
Value of floor space (If usable)		
Ave. property taxes and insurance (1%)*		
Overhead expenses (Except depreciation)##		
Other		
CAPITAL COSTS		
--Old Equipment		
Reduction in conversion value during year		
Interest on conversion value at beginning of year (4%)		
Major Repair $_____, divided by Years of increased life _____		
Ave. Interest on Major Repair (2%)*		
--New Equipment		
Yearly depreciation (Other side)		
Ave. Interest on net installed cost (2%)*		
Total Advantage		
Net Advantage -- Old or New Equipment		
Income Tax at 55%		
Estimated Advantage Next Year (after taxes)		

Note: Support all advantage estimates by detailed computations on attached worksheet.

Comments by estimator_____

*See Manual. # 2.46% of the four labor accounts above. ## 90% of Direct Labor.

EXHIBIT 1 (Part 2)

for determining the length of the pay-off period to be required. To quote one such requirement, "The payout period most desired by the Diamond Match Company is two to four years, based on earnings or cost savings before taxes."[4] However, the length of the pay-off period is critical in the computations, for the difference between a two-year and a four-year pay-off period is a 25 per cent difference in required rate of return considered as a signal for replacements. Since the pay-off period is both arbitrary and critical at the same time, the method has little scientific footing.

A third common way of evaluating capital expenditure proposals, is the "rate-of-return method." This method of evaluating profitability is theoretically simply the reciprocal of the short pay-off period method. However, in practice, the rate of return required, would, in most cases, appear to indicate a longer pay-off period than is customary under the normal short-pay-off requirement. Terborgh points out the illogical nature of this method in its usual form. He suggests, "All that is necessary to get a higher return is to wait a little longer. . . . It treats as net return on the replacement investment what is in part simply relief from losses occasioned by the undue deferment of replacement."[5] If this method is refined, it will be the equivalent of the orthodox engineering-minimum-average-cost formula. However, it is ordinarily used in an arbitrary form as a rule-of-thumb method similar to the short-pay-off method.

Engineering Formula Approaches: Special and Orthodox

The fourth alternative approach to fixed asset decisions may be called the formula approach. A group of special formulas is perhaps best illustrated by Terborgh's two. He presents the M.A.P.I. formula[6] and another one in *Dynamic Equipment Policy*.[7] Both formulas are similar in results but differ in mechanical details. They are an application of the orthodox engineering formula, with an arbitrary and uniform rate of obsolescence built into them. If this rate of obsolescence could be determined accurately, the formulas would be appropriate. The assumption of the accumulation of operating inferiority at a constant rate for the new asset is, in actual fact, simply the reciprocal of the normal estimate of years of life of the asset, shortened to allow for obsolescence. The only practical method suggested, it seems to me, for estimating the "inferiority gradient" (accumulated obsolescence) of the new asset, is to base it on the actual obolescence which has taken place in the asset, perhaps modified by an estimate of the effect of changed conditions. Exactly the same results can be secured by using the orthodox formula and estimating obsolescence in terms of number of years of life rather than the unfamiliar and cumbersome method of estimating the "inferiority gradient." In fact, Terborgh, in several of the examples, actually uses yearly obsolescence estimates, instead of trying to apply the gradient.

4. National Industrial Conference Board, *Controlling Capital Expenditures*, Studies in Business Policy No. 62, National Industrial Conference Board, Inc., 247 Park Avenue, New York, 1953, p. 53.
5. Terborgh, George, *Op. Cit.*, pp. 206-7.
6. *M.A.P.I. Replacement Manual*, Machinery and Applied Products Institute, Chicago 3, Illinois, 1950.
7. Terborgh, George, *Op. Cit.*

The Terborgh methods, if used by the unwary, can, I think, lead to unsatisfactory results. The M.A.P.I. formula approach has been simplified to such an extent that the hidden implications of the constant increment of obsolescence assumptions are not apparent. If it is not used with understanding and sympathy, the method can be misleading because it appears to be so simple and automatic. The more elaborate formulation in *Dynamic Equipment Policy* is not automatic in application and, therefore, complex to apply. The "inferiority gradient," which is all that the author claims for his approach as a distinction from the orthodox formula, is an unnatural way for most people to look at obsolescence. Therefore, it is confusing to use. Practically speaking, it is difficult to find advantages for the Terborgh approach over the orthodox engineering approach, which counterbalance the pitfalls or the complexity of the former.

The fifth method which may be included in those out of which choice must be made in basing evaluation of capital expenditure problems, is the engineering-minimum-average-cost formula which is to be found in texts on engineering economy by such authors as: Grant,[8] Bullinger,[9] and Woods and DeGarmo.[10] These treatments do not indicate clearly what specific items must be included for consideration and very few forms are presented. A mere statement of the engineering-minimum-average-cost formula is little practical help without the forms and schedules necessary to give it meaning. It is with the idea of implementing the formula and extending it to its logical conclusion of balancing marginal productivities that the plan for use in allocating expenditures for capital assets, offered in subsequent sections of this article, is presented.

A Method Which Depends on Profitability of Expenditure Proposals

The plan or program on which this paper is based attempts to balance capital availability with capital usage. It goes even to the point of suggesting an attempted balance between the rates of capital for use and the rates of capital in use. Specifically, the rates on available capital are to be balanced against the rates that the capital will produce when in use in a particular company.

The amount of capital to be available must first be approximated. A profitable company will have capital available from within for the replacement and pur-

8. Grant, Eugene L., *Principles of Engineering Economy*, Third Edition, Ronald Press Co., New York, 1950.

9. Bullinger, Clarence E., *Engineering Economic Analysis*, McGraw-Hill Book Co., Inc., New York, 1942.

10. Woods, Baldwin M., and DeGarmo, E. Paul, *Engineering Economy*, The Macmillan Co., New York, 1950.

Form EAR-2

E-Number_____
Type_____
Dept._____
Date_____

EQUIPMENT ANALYSIS REPORT

Expansion and Product Improvement

New Equipment_____

Description of New Equipment_____

Manufacturer_____
Estimated Installed Cost $_____ ; Est. Life _____ ; Yearly Depr. $_____
Est. Salvage Value $_____ ; Other Equipment Required_____
Description of New Process or Product_____

SUMMARY

Estimated Installed Cost of New Equipment $_____
Estimated Yield (Average Yearly after Taxes) $_____
Percent of Net Yield on Capital Expenditure _____%
Evaluation of Intangibles (Selling Advantages -- Product Mix -- Advertising -- Prestige -- Product or Process Flow -- Safety --Etc.)_____

Comments_____

Priority Rating based on Net Yield and Intangibles_____

EXHIBIT 2 (Part 1)

chase of new assets. There is the possibility of capital becoming available from the outside at certain rates and under specific conditions. The capital available from within is usually of three basic types. There are, of course, the retained earnings which are, to a certain extent, available for the purchase of new assets and there is likewise, for consideration in this connection, the amount of the current depreciation entry, plus perhaps some accumulation of depreciation. Although the depreciation accumulation may not be in liquid form, it is usually considered available for capital expenditures and rightly to be so used. There are also a few miscellaneous occasional sources, such as contingency reserve transfers (temporarily liquid and available), sale of fixed assets, viz., unused buildings or plant sites, lowering inventory, or shortening collection period.

Securing capital from the outside may take the form of bank loans, mortgages, notes sold in insurance companies, or the sale of bonds or stocks. Consideration of outside capital may indicate that the actual rate as a cost may not be as important as the risk involved or the irksomeness of outside intervention or supervision. The annoyance and cost of meeting Securities and Exchange Commission

ESTIMATED OPERATIONAL ADVANTAGES

(Estimated Average Yearly Advantages over Estimated Life)

INCOME (Average Yearly)		
Saleable volume of product_____		
At average price per unit $_____		
Average Yearly Sales Increase		$_____
If results only in increase in old line:		
Average increase in product volume_____		
At average price per unit $_____		
Average Yearly Sales Increase		$_____
Deduct: Sales, Shipping, and General and Adm. Expense,_____%		$_____
Estimated increase in income after S., S., G. & A.		$_____
OPERATING COSTS (Average Yearly)		
Direct material	$_____	
Direct labor	_____	
Indirect labor	_____	
Set-up time	_____	
Overtime and shop premiums	_____	
Payroll taxes and work compensation #	_____	
Power consumption	_____	
Gas and water	_____	
Maintenance and repairs	_____	
Tool costs	_____	
Supplies	_____	
Spoilage -- Scrap	_____	
Defective output -- Rework	_____	
Downtime	_____	
Ave. property taxes and insurance (1%)*	_____	
Overhead expenses (Except depreciation) ##	_____	
Other	_____	
CAPITAL COSTS		
Yearly depreciation (Other side)	_____	
Ave. interest on net installed cost (2%)*	_____	
Total average yearly costs		$_____
Average yearly net income		$_____
Income tax at 55%		$_____
Estimated Yield (Average yearly after taxes)		$_____

Comments by estimator_____

*See Manual. # 2.46% of the four labor accounts above. ## 90% of Direct Labor.

EXHIBIT 2 (Part 2)

regulations may outweigh several percentage points difference in interest or productivity rates.

It is important to remember that the true availability of capital is not known, however, until the prospective productivity of the projected asset purchases is evaluated. It is not proper to assume that a certain fixed sum of capital is available, except in the case of the closely-held family company which adheres to a fixed plan of expansion and reinvestment out of internally generated funds, with no recourse to outside capital. For other companies, capital availability is limited only by the ingenuity of management in conceiving, organizing, and process-

ing plans for productive asset groupings which offer (or appear to offer) better profit prospects than other companies can muster.

The present capital productivity rate within the firm is to be found in the profit and loss and balance sheet figures. If the rate of earnings per dollar invested is averaged with the rate at which money can be borrowed, this combined rate will establish the minimum per cent of yield which must be offered by the proposed new assets. Most progressive companies find that there are many good prospects for usage of capital in assets for various production possibilities. It is, therefore, necessary to predetermine carefully and accurately the potential profit productivity of the proposed new assets and ration or assign preference ratings to them until the capital availability rate and the capital productivity rate are equal. A schedule of productivity of the proposed assets should be made which places the most profitable projects at the head of the list. A hierachy can be drawn up with the most profitable ones first, followed by less profitable ones, until the cut-off rate is reached where the capital available is used up.

Analysis for Determination of Project Profitability

A system which suggests comparing prospective productivity with present productivity of assets cannot be based upon such rule-of-thumb methods as the "short pay-off period." It is necessary to analyze the proposed new equipment in detail and by uniform methods for each piece. The figures which are presented for the new assets must be comparable to the figures management regularly uses in evaluating old assets and production processes. Therefore, it is suggested that all proposed assets be analyzed on one of three type of Equipment Analysis Reports: for Replacement and Service Facilities (Exhibit 1), for Expansion or Product Improvement Items (Exhibit 2), and for Buildings, Furniture, New Office Equipment, Special Projects, and Employee Services (Exhibit 3).

Replacements bulk large in the total expenditures made by mature companies. Usually, not only the type of replacement but also the time to replace, must be determined. Exhibit 1 is suggested for use in the analysis of replacement type assets where a new item is to be compared with the old one, to determine both whether it is time to replace and what replacement is to be recommended. The top right-hand corner of this form is to be used for filing purposes. An asset-type classification is implied (which is not discussed in this paper because of lack of space). The central part of the sheet gives pertinent facts on the new asset and the old equipment which it is proposed to replace. The bottom section, entitled "summary," relates the advantage (from the reverse side of the sheet) to the estimated installed cost, to give a net yield figure on the capital expendi-

ture. A space is furnished for the evaluation of intangibles and for comments.

The reverse side of this form compares the old equipment with the proposed new assets, cost by cost. Since this sheet is used for replacements, a net advantage after taxes is to be determined for either the old or the new one. If the old equipment is not worn out or obsolete, the form will show an advantage for the old equipment and thereby indicate delay in replacement. The top section is for income advantages at the plant level, that is, income net of selling, advertising, and general and administrative costs. This section may present the greatest difficulties for computation. However, the author has prepared these analysis sheets for several types of replacements and has found it possible to work out appropriate income advantage figures in every case. Of course, if the proposed asset will not change the income produced, but will simply replace the old assets and supply the same income producing facilities, no entry need be made in either column. Note that the columns are headed "advantages." The same holds true for the cost section. If the new equipment is to cost the same to operate as the old, nothing need be entered in the operating cost advantages section. However, some of the costs will surely be different, so each must be carefully studied. Only the difference in cost, or added cost, is to be entered.

The operating cost advantages section, the middle portion, should be built up in exactly the same manner as the company presents its profit and loss statement. These are all of the operating cost items in the order in which they appear in the company's profit and loss statement.

The section on capital cost deserves some attention. It has a number of peculiarities. It starts out with old equipment. Nothing will be placed in this section unless there is to be a definite reduction in the conversion value during the ensuing year. If the old equipment is now worth scrap value and if, at the end of the year, it will still be worth scrap value, there will be no entry.

An example of the reduction in conversion value might be of the following type. If the machine were sold at the beginning of the year, it would bring $500. However, if it is used for the year, at the end of the year it would be completely worn out and not salable. It would be worth about $100 as junk or scrap. In this case, the reduction in conversion value during the year would be $400. However, this is not difference in book values. This is actual salable values. The interest entry suggested would apply. The four per cent rate has been chosen as appropriate, since that is a reasonable net borrowing rate. Interest cost differences are important in choosing between items, especially when large differences in capital value exist, as is usually true between an old and a new asset. If a major repair might be feasible for the old equipment, the

Form EAR-3

E-Number_____
Type _____
Dept. _____
Date _____

EQUIPMENT ANALYSIS REPORT

Buildings, Furniture, Office Equipment, Special Projects, Employee Services

New Equipment_____

Description of New Equipment_____

Manufacturer_____
Estimated Installed Cost $_____; Est. Life _____; Yearly Depr. $_____
Est. Salvage Value $_____; Other Equipment Required_____

Description of need for New Equipment_____

Fill in and attach Check List -- Form EAR-4.

Attach cost analysis sheets for alternative types of materials, construction, or processes. (Where appropriate, attach cost analysis sheets for alternative locations or methods.

Comments_____

Priority Rating_____

EXHIBIT 3 (Part 1)

amount should be entered and divided by the years of increased life and extended as yearly amortization cost. Interest on the cost of the major repair at its average value (or two per cent instead of four per cent) should be entered.

Below old equipment in the capital cost section of the reverse side of Exhibit 1 comes the portion relating to new equipment. Depreciation must be computed on the new equipment, as contrasted with the old. The old equipment is something that you already have. It is a sunk cost. The fact that the old equipment may be only partly depreciated is a matter which should not influence the decision about the purchase of new equipment. The decision to purchase a new asset must not be influenced by whether the right or wrong depreciation has been taken on the old asset. Eugene Grant has clearly stated the case against taking depreciation on the old asset when evaluating a new one.

"Once the principle is recognized that it is the difference between alternatives that is relevant in their comparison, it follows that the only possible differences between

EQUIPMENT ANALYSIS REPORT

Check List

(To accompany assets without direct productivity)
(Attach to Form EAR-3)

Equipment _____

Reason for recommendation _____

_____

GENERAL:

	Yes	No
Is it indispensable to company policy?	—	—
Does it follow all phases of company policy?	—	—
Has the long term pattern of future expansion been considered?	—	—
Has a saleable volume estimate of its production been made?	—	—
Have all possible alternatives been considered?	—	—
Will the product be improved?	—	—
Are associated working conditions safe and do they meet company policy requirements?	—	—
Have all needs for associated equipment been considered and included?	—	—

* * * * *

Complete carefully the appropriate section below:

I. Buildings and Grounds.		
Is it harmonious with old buildings?	—	—
Does it fit into long range building program?	—	—
Has it been located correctly in relation to material handling and ease of access?	—	—
Have all alternate construction types been evaluated?	—	—
Is it the most economical size in the long-run?	—	—
Are the materials specified those which will withstand the required usage?	—	—
If an addition to an old building, is it more satisfactory economically than building a new one?	—	—
Are special features, such as, floors, roof, windows, approaches of similar quality?	—	—
Is plumbing and hardware adequate?	—	—
Has heating, ventilation and lighting been checked for conformity with company and other standards?	—	—
Is electricity, water and power readily available?	—	—
Have roads, approaches, and necessary material handling arrangements been made?	—	—
How long will it remain in efficient condition? _____		
II. Furniture.		
Is the proposed furniture:		
Made of material comparable to other pieces in room?	—	—
Harmonious color?	—	—
Durable material and construction?	—	—

EXHIBIT 3 (Part 2)

alternatives for the future are differences in the future. Any decision regarding a course of action for the future starts from now. Whatever has happened up to date has already happened and cannot be changed by any choice among alternatives for the future. This applies to past receipts and disbursements as well as to other matters in the past. From the viewpoint of an economy study, a past cost should be thought of

	Yes	No
Usable elsewhere if needed?	___	___
Proper size?	___	___
Appropriate height?	___	___
Comfortable for user?	___	___
Is it fireproof (for files, etc.)	___	___
Does it fit into long range office development pattern?	___	___
Could the old furniture be rehabilitated?	___	___
III. Office Equipment.		
Have alternate brands been tested?	___	___
Have alternate procedures been considered?	___	___
Does it have ample capacity for peak loads?	___	___
Is the speed, accuracy and touch comparable to others?	___	___
Will it save worker time?	___	___
Will it fit available space?	___	___
Will it have a reasonable trade-in value?	___	___
If replacement, is old machine to be traded in or sold?	___	___
Can seller service it adequately and without delay?	___	___
Will it require other associated equipment?	___	___
Will it require new stands, tables, or supports?	___	___
Will it require special wiring or new utility outlets?	___	___
Will it require special protective devices?	___	___
Will it require an operator with a new, different, or special skill or training?	___	___
Is a saving in procedure or method possible? Explain_____	___	___
IV. Special Projects.		
Has research and engineering been completed for entire project?	___	___
Could greater savings be realized or more advantages be shown by a further extension of the project?	___	___
Could the project be done by an outside agency for a fee? If so, how would it compare?_____	___	___
Will this change methods, procedure or product quality? Explain_____	___	___
V. Safety, Working Conditions and Employee Services.		
Is it adequate to meet safety standards of the company?	___	___
Will it increase output?	___	___
Will it reduce the physical exertion required?	___	___
Will employees recognize the advantages?	___	___
Will worker health be improved?	___	___
Will it improve employee morale?	___	___
Have employees requested it?	___	___
Is it required by union contract?	___	___
Will it serve others than employees and improve public relations?	___	___
Is it a part of the long term company program for Y. M. C. A. or religious advancement?	___	___

Questions answered by_____ Date_____

EXHIBIT 3 (Part 3)

as a *sunk cost*, irrelevant in the cost except as its magnitude may somehow influence future receipts or disbursements or other future matters."[11]

11. Grant, Eugene, *Op. Cit.*, p. 330.

The amount to enter as depreciation on the new asset has been entered on the front side of Exhibit 1 and should be brought into the proper column. An average interest rate of two per cent on net installed cost is indicated. This two per cent compares directly with the four per cent which is indicated above, on the assumption that the original cost of the asset will be balanced over its life by the accumulation of the reserve, so that interest on half the cost is appropriate.

The Summing Up

It is now possible to total the advantage of each column for the old and new asset. It must be observed that the advantage of the new equipment is the disadvantage of the old equipment. So, in some cases, the old equipment disadvantages will be the items placed in the new equipment advantage column and vice versa. In other words, disadvantages cost-wise for the new equipment will be placed in the old equipment advantage column, as for example, depreciation on the new equipment goes in the old equipment advantage column.

The difference between the two advantage columns is the net advantage for either the new or the old equipment, which should be entered on the line for "net advantage." Income tax should be computed on this net advantage at the approximate rate for the company. The 1953 income tax rate was fifty per cent, plus the state income tax rates applicable, and any excess profits taxes, if they apply to the company. The rate of fifty-five per cent appears in the form only as a reasonable average. The net advantage (after taxes) results from these data and should be carried to the front of the sheet on the line indicated. Space is provided for comments by the estimator. It will be observed that footnotes in the comment section indicate rates to be used to apply payroll taxes and workman's compensation costs and another to apply overhead. Each of these should be based on company costs and percentages. The same thing is true for the determination of the rate for applying property taxes and insurance.

Estimated advantage next year (after taxes) is brought from the reverse side and entered in the Summary section on the front of Exhibit 1. The estimated advantage, when divided by the estimated installed cost directly above it, gives the per cent of net yield on the proposed capital expenditure. This is projected yield, to be sure, but all the costs have been considered. It is not the same sort of thing that results from applying the number-of-years-recovery method or the rate-of-return procedure in its usual form. Everything which would appear in the profit and loss statement has been included on this analysis sheet. All possible costs have been considered. Therefore, to the extent that costs have been

correctly estimated for the old and new equipment, the per cent of net yield on the proposed capital expenditure is comparable to the actual net yield figure.

Different Analyses for Different Purposes

The second equipment analysis report suggested is that for expansion or product improvement items, and has been identified as Exhibit 2. The front of it is approximately the same as Exhibit 1 except that, since an old asset is not being replaced, only information on the new asset is included. The reverse side, however, is somewhat different. A pro forma profit and loss statement for the new project is presented. Any new item will have to be taken as a part of an entire project for any part of a project is absolutely essential, if the project is to be used. Therefore, it is impractical or even impossible to analyze each item separately. This form does not deal with advantages of old and new equipment. The entire income to be added (or the salable volume of product at the average price) is the average yearly sales increase.

The figures which would be of the same type as those used in the budget should be inserted on the reverse side of Exhibit 2. However, the computations for this form would have to precede the budget figures, because these figures should antedate the decision to include the project in the budget. Exhibit 2 contains the same group of operating cost figures as those to be found on the reverse side of Exhibit 1 (with minor exceptions where inappropriateness is apparent). The income section is somewhat different because it is necessary to consider sales, shipping, general and administrative expenses, items which do not need to be included when considering the advantages of an old versus a new asset. Capital costs are included with the operating costs in the usual manner. The total average yearly cost figure is subtracted from the average yearly income to secure the estimated yield, from which the income tax percentage is deducted. The estimated net average annual yield (after taxes) is carried to the front of the sheet and a per cent of net yield (after taxes) on the capital expenditure, is presented. There is a place provided for the evaluation of intangibles, such as selling advantages, product-mix, advertising, prestige, product or process flow, safety in working conditions, and any of the other possible intangibles appropriate.

One point should be stressed. The per cent of net yield on capital expenditure has been designed so that it is directly comparable on both Exhibits 1 and 2, as well as with the present net yield on capital already in use. The percentages from the two forms can be placed side by side. If you get 6.3 per cent on one and 6.3 per cent on the other, they should mean the same thing. When a net yield of 6.3 per cent is shown on a replacement and 9.3 per cent on a new item, it

seems clear that the new project should be installed rather than make the replacement. A difference of two or three tenths of a percentage point would not be important enough to dictate a major change. Perhaps even one percentage point might not be decisive until the intangibles were carefully evaluated. However, these percentage figures will not be the fabulous (and nebulous) ones shown by the simple two or three year pay-off method and should not be thought of in that light. These percentages have considered all costs (not just a few selected, obvious ones) and income taxes have been deducted.

There are some projects or pieces of equipment with respect to which it is impossible to compute profitability. These should be placed on a separate type of analysis sheet. Exhibit 3 proper has been designed for items of this type. This is an equipment analysis report for buildings, furniture, new office equipment, special projects, and employee services, and should be used for any item for which direct profitability cannot be determined. The accuracy and significance of the other two types of equipment analysis reports should not be diluted by including on them items for which profitability cannot be determined. This would tend to bring laxity in the treatment of all forms.

Exhibit 3 must depend heavily on the attached cost analyses sheets for alternative types of materials, construction, or processes. When alternative locations and methods are available, they should be analyzed and the results attached. Each proposed asset in this group has its own problems associated with it.

A checklist, shown here as a part of Exhibit 3, but, in practice, a supplementary form, should be filled out and attached to it. The questions included may not be the best questions or all of the questions to be asked and answered in all firms. However, top management needs to know that questions of these types have been considered, answered and signed for, by a responsible executive. The checklist contains a section of general questions and specific questions applicable to various types of assets. It seems important to implement in this way the information presented on Exhibit 3 proper for such vague expenditures as lighting a company ball park, or installing showers, or a new cafeteria, or putting new furniture in a reception room.

Procedure for Allocation of the Capital Budget to Projects

It will be noted that, at the bottom right-hand corner of each exhibit is a space for the insertion by the appropriations committee of the priority rating which places the projected assets in the hierarchy of the capital budget. This brings us to highly practical matters. Capital allocation must have certain mechanical details attached to it and must include a formal procedure. Financial

management cannot shift that responsibility to the engineering department. I have great respect for the engineers. They have a big job before them. After they have been at it a while, perhaps they often feel that, in answering questions, they are placed in the position of submitting reports which are so technical that others do not understand them. I think, in many cases, financial management has imposed on the engineer by expecting him to do a great many things in a field in which he has had little training or experience, such as general economic analysis, analysis of business conditions, and evaluation of sales potential. For instance, the equipment engineer may be proposing a machine which will produce 1,000,000 units. He has no means of judging whether that volume is considered salable by the company or not. Financial management often assumes that he does know and, without evaluating the matter, acts on the proposition—which may be a critical matter—without either party to the study knowing or even having investigated the possibilities.

Most of the difficult problems in connection with asset purchases are not mechanical. These problems lie in the realm of estimates of future sales, future prices, future income, and future business conditions during the life of the asset proposed. The second area of great difficulty is in the evaluation of different intangibles. How important is safety? How important are labor working conditions? How important is a facility which is of a morale-building nature almost exclusively? Is the equipment engineer looking at the future and the general facilities in the same way that management is? It seems obvious that the engineers have had the greatest responsibility and greatest influence on the purchase of fixed assets, especially in production organizations. There is no way to escape that, but the evaluation of intangibles should be spelled out in greater detail, so that greater uniformity in assumptions and knowledge is effected. Especially in periods of re-equipment, such as the post-war era, and in times of inflation, financial management must accept greater responsibilities than it has taken for asset purchases up to this time.

The mechanical details of a program which would meet these conditions should be presented briefly. First, there should be a formal equipment proposal, which would control the accumulation of information on the project or asset. Second, equipment analysis reports of the three types already presented should be filled in. These equipment analysis reports should be sorted by the equipment engineer and the chief engineer and their staff on the basis of profitability. A hierarchy of these projects should be set up, based on their net yield percentages. The group selected should aggregate perhaps 150 per cent of the amount that the engineer has been told could be spent on new assets.

Next, an appropriations committee, composed of top executives, should review this information which the engineering staff has assembled and should assign a priority rating to each proposal. The priority rating in each case should be determined by the appropriations committee, not by the engineering department. Top executives are the only ones capable of passing on the weight to be given to intangible considerations. That is the reason these considerations should be clearly indicated on the forms. Top management is often presented a capital budget by the engineering staff and often accepts it without a clear understanding of the underlying assumptions and the intangibles involved. The planning schedule or the capital budget is automatically complete when, as indicated, the appropriations committee assigns the priority rating in the bottom right-hand corner of the equipment analysis report. The mechanics of assembling these projects may be the responsibility of either the enginering department or the budget or accounting department. The approval of the capital budget by the board of directors becomes the basis for the issuance of equipment orders. Emergency cases will always arise, and should be handled individually by the appropriations committee. There should be the usual appropriation progress schedules, asset completion reports, and disposal reports, in make-up appropriate to the company's other forms. Of course, a project justification summary should be prepared, not to prove that the engineer was right or wrong but to assist the appropriations committee in making similar decisions.

The Part That Policy Plays

A program of the type outlined for determining the justification for a company to purchase assets must entail responsibilities. The engineering department has traditionally borne much of this responsibility and must continue to. However, cost departments, controller's departments, and sales departments should play a much greater role than they do in most companies, especially the sales department. The sales department should be induced to participate to a greater extent, not only to secure cooperation in supplying sales projections and estimates, but also to help in determining asset purchases which will produce the products the sales department must sell for the next fifteen to forty years.

Because of the long-term nature of the commitment that asset purchases represent, top management must assume final responsibility for making the decisions. Top management needs much more accurate and precise information and assistance in making decisions than it can get from the various rule-of-thumb methods of presenting asset purchase evaluations so common in industry. Top management does, however, have the responsibility to its subordinates of clearly

defining certain concepts so that uniformity in thinking about them will prevail. Some of the important areas in which company policy should be clearly enunciated are set forth in the paragraphs which follow.

What volume and what capacity does management consider appropriate? The engineer cannot make intelligent estimates unless he knows whether to count on one shift, two shifts, two and one-half shifts, or staggered operations of some sort—and this is for the life of the asset of fifteen to forty years.

What is quality? What does management or the company's customers consider to be quality? Many engineers assume that they know what quality is. However, is it defined as engineering elegance, as engineering precision, or is it economy efficiency? The engineer probably would prefer it to be engineering elegance, because it is pleasant to work with the finest machines. The engineer, if turned loose, perhaps might have a tendency to interpret quality liberally.

As an example of the problem of understanding the meaning and implications of quality, a simple illustration is appropriate. What is quality in wash rooms? In tours through many plants, I have seen all types of wash rooms from simple, even primitive, ones to luxurious ones which rival resort hotel accommodations. Some are wooden, some concrete, some tile, some metal.

Before anything can be concluded or recommended about asset purchases, there must be a thorough understanding of repair and maintenance policy. How much repair and maintenance does management feel is appropriate. It is possible to keep on repairing an old asset for perhaps five, ten, or even fifteen years. The older group of engineers had a tendency to feel that one of the objectives of engineering was to keep an old asset going as long as possible. The modern engineer appears to stress streamlining, replacing as soon as possible, buying new modern machines with added safety features, and especially higher speeds to increase output per labor dollar.

Obsolescence should be carefully defined. Economic obsolescence may not become obvious to the engineering department as soon as the sales department recognizes it, because the machine may be mechanically perfect. Some engineers have contended that assets are becoming obsolete more rapidly than they formerly did, perhaps because of streamlining. It is difficult to see how general purpose assets could, on the whole, be expected to have a shorter economic life. To the extent that assets are becoming more specialized, it may be true. There may be a step-up in obsolescence in some types of industries, because obsolescence is a function of increasing specialization of equipment.

A clear-cut policy on asset disposal should be set down. It is easy to retire an asset, leave it around, and then find that some line executive has picked it up

and put it in the production line somewhere else by using his maintenance labor. A complete equipment analysis report should be required before assets may be reinstalled because, in most cases, it would probably be cheaper in the long run to buy a new, well-designed asset.

Some policy on the keeping of stand-by facilities should be stated. It may be wise to retain some assets for use in case of breakdowns or production disturbances. It may even be economically sound to retain enough excess capacity to make possible the addition of another shift without expansion. The company should have a policy. The engineer and others concerned should know what it is.

Safety conditions and working conditions which, in general, are considered appropriate by management should be generally understood. Many safety features, such as guard rails, special treads, protective fuses and switches, and hoods for fumes must be built into the asset and included in the basic design and specifications. They may be overlooked if they do not become a part of the original engineering conception.

There should be some definition of what building structure is proper, and how the building should be located. A fireproof building may assume many shapes, forms, and sizes-multistoried, windowless, air conditioned, streamlined, modernistic, or just another monitor type or saw-tooth warehouse type. The buildings and grounds may be a showplace in themselves.

Responsibility Is Exercised by Individuals

Management, especially financial management, must assume responsibility for supplying definitions and policy pronouncements in these areas, so that the engineering staff and the board of directors look at them with similar assumptions and understanding. The engineer makes his decision on the basis of what he assumes to be true. The project is presented to the board. The board either accepts or rejects and it may do so anticipating very different results from those that the person proposing the asset purchase had in mind.

Responsibility is on people. It is not on forms. It is not on rates. With energetic, responsible, resourceful, and capable people, you can afford almost anything (within reason). People of this calibre can make it work out, if properly organized. But, without these people, you cannot afford to spend a cent on assets, anyway. After you have decided upon the balancing of rates, you must have the people to make the decisions which are necessary. The forms may help them organize their information and supplement their knowledge. However, there is no escaping the conclusion that people with judgment are far more important than is the comparability of profit rates, no matter how scientifically determined.

Avenues For Inventory Control Analysis

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You don't just "break it down"—the inventory dollar balance or the process stream into units or dollars. Inventory control is a broad subject. There are many needs for inventory information and the five approaches here described, with their services and difficulties frankly and discerningly set forth, each answer to some of these needs in part or in whole. The authors address themselves to the objective of providing an understanding of the uses of types of inventory control analyses.

THE SUBJECT OF INVENTORY CONTROL is becoming increasingly popular at this time. The topic is timely in that the questions of recession—real, fancied, or feated—is a somewhat new feature of business conditions after over fifteen years of almost uninterrupted rising volume and prices. Another reason for the popularity of the topic is the possible effect of this leveling off upon companies which carried out product diversification programs during the post-war period. These diversification programs have often resulted in slow inventory movements and have accentuated the possibilities of inventory obsolescence.

Similarly, many companies are now making organized attempts to analyze and simplify their product line. This analysis of item profitability focuses considerable attention upon inventories. In addition, the growing popularity of return on investment as a control device has brought about more searching analysis of inventories and their usefulness. There are also recent developments in the theory of inventory analysis and control. Of especial importance are the operations research techniques which make use of probability theory to analyze the propriety of inventory levels. Another recent development is the mathematical approaches which point towards programming of inventory levels and production quantities.

Types of Inventory Control Analysis

The purpose of this paper is to indicate the kinds of data required for most types of inventory control analysis and to discuss some of the obstacles involved in making these data available and using them in a realistic manner. For purposes of this discussion, it is convenient to distinguish between five different types of analysis which are or can be used in inventory control studies.

1. *Activity analysis.* The basic analysis most often used to improve inventory control relates to activity. This activity is usually expressed in terms of a turnover figure, annual turnover being the most common one.

2. *Work in process analysis.* Another form of inventory analysis involves the study of where and at what stage of manufacture inventories are within the firm and the accumulation of cost represented in these inventories. This approach is especially useful for the study of work-in-process inventories and their relation to production planning systems. It is also necessary to have knowledge about work-in-process inventories for plant layout and materials handling studies.

3. *Economic lot quantity analysis.* There are many occasions on which economic quantity analysis is desirable. The basic purpose of this type of study is to find the combination of ordering or setting up costs and inventory carrying charges which will result in the lowest total combination of these elements of manufacturing cost.

4. *Production and inventory control systems analysis.* Another basic form of analysis relates to the appraisal of a system of inventory control. This involves understanding the actual flow of papers and communication used by the organizational groups which make and carry out inventory and production control decisions. It attempts to measure the performance of the system in use and to compare the possible change in performance which might result from revising the system and incurring more or less expense to operate it.

5. *Quantitative analysis.* One of the most promising and certainly one of the newest types of inventory analysis involves the quantification, by the use of operations research techniques, of the costs, returns, and other relationships in business operation. This method is used in problems previously handled by simpler techniques or dealt with on a qualitative basis. Another phase of these approaches to inventory analysis is the placing of emphasis upon study of the total system rather than its pieces, through the use of mathematical programming.

Activity Analysis

The types of inventory analysis briefly described above will be discussed in turn. Although turnover is probably the most widely-used yardstick for inventory control, it is a tool which has many shortcomings. It is probable that no one item in a large inventory population is behaving at the average rate of turnover. A turnover figure tells nothing of the items of which there are too few, or of the distribution of the items of which there are too many—conditions which may exist even when the inventory has an ideal total turnover. Similarly, turnover tells nothing about the time series aspect of inventories. For working capital and other planning purposes, it is necessary to know something of the peaks and valleys in production and inventory needs. These variations are obscured when they are averaged out over some turnover time period.

In addition, turnover measures reveal nothing of the distinction between fast-moving and slow-moving items, the average turnover of which cannot reflect their different movements. A turnover figure is weak also in that it makes no particular distinction between cheap or expensive items. A few expensive items can sometimes influence a total turnover in a startling and misleading way. Finally, turnover figures do not indicate which portions of an inventory earn a

return because they are the economic portions and which portions serve no purpose and are undesirable.

Moreover, there are several major cost accounting problems involved in obtaining turnover data. One difficulty relates to the decision as to whether dollars or units are to be used as the turnover measure. Units tend to be too clumsy, so that dollars are most often used. This, however, involves the problem of inventory pricing, with the resulting difficulty that the turnover of any inventory may appear greatly changed by a change in the basis upon which the components are priced. A change in standards, costing method, or valuation method (such as a switch to "lifo") might cause this type of distortion. Another difficulty is that physical dollar inventories are seldom taken, and, thus, book inventory figures tend to be somewhat inaccurate. A third difficulty is that it is usually necessary to use standard cost figures for inventories, especially for analyzing work-in-process inventories, and this tends to obscure investments. Direct costing would be an extreme example of this.

It would thus appear that total turnover figures are a poor inventory measure, and a difficult one to handle. It is usually necessary to break turnover figures down into subdivisions which are pertinent to the particular form of analysis required. It is very difficult to predict ahead of time what breakdown will be most desirable and the breakdown will, of course, be different for different purposes. Still, although turnover is an incomplete analysis yardstick, it should not be concluded that turnover figures are without any significance. Absolute inventory investment figures become more meaningful when they are related to activity, even though there are no absolute standards of activity. Turnover figures provide one of the few ways to measure performance of different products in a product line and permit comparison of different organizational divisions within a firm. They are also useful for comparing performance over different periods of time. Turnover will thus remain a major tool of inventory analysis.

Work-in-Process Analysis

A particular kind of analysis involving studying the content and location of inventories often must be made of work-in-process as well as of raw materials and finished goods. It is necessary to have detailed knowledge of work-in-process inventories for plant layout studies, for decisions between the alternative methods of materials handling. One of the major reasons for adopting certain forms of line production is that the work-in-process stream is shortened and inventories are reduced. Similarly, there should be good work-in-process data available for any type of lead-time study. Lead times may be abbreviated if some

material is processed ahead of time and is carried in a semi-finished condition. Some firms build up preferred positions in short-order business because of their virtuosity in handling work-in-process inventories.

Knowledge of the value and location of inventories is equally important in the operation of production planning systems. In many companies, the production planning group keeps its own inventory records for in-process inventories apart from the accounting records simply because the inventory account classification and accounting procedures are inadequate for the needs of a production planning system. Although often necessary, this double record-keeping may be carried to the point of absurdity. It is not hard to discover situations where nearly similar but, nevertheless, quite distinct perpetual inventories are kept for years on the same items, in the same firm, by different but adjacent groups.

We should perhaps mention, as well, that knowledge of work-in-process inventories is vital for many purposes of accountability. Departmental or divisional managers are typically quite conscious of their responsibility for the inventories under their control and need frequent, accurate, and adequate reports of inventory status. These managers are usually watchful of the manner in which the accounting department charges and credits them, because they must answer for the company dollars which they have put to use. The accounting department is, for this reason and for many bookkeeping and accounting reasons of its own, anxious that the inventory information and analyses be adequate.

Some of the analytical difficulties in using reported dollar work-in-process inventories need mention. First of all, it is not uncommon for factory accounting systems to be so designed as to have the fewest possible number of in-process ledger accounts (say, one per division) and thus no ready means of breaking down inventory by products or by processes, except at the time of physical inventories. Also, if tabulating equipment is used, there may not even be sufficient information punched on the cards to permit breaking down the book inventory. Another difficulty is encountered by inventory analysts when they discover that the timing of accounting charges is out of phase with the production process. Examples of this are when special materials are charged into process long before work actually begins, when waste elements are allowed to pile up in the inventory and are not removed at regular intervals, and when burden absorption anticipates or lags behind the production process in such a way as seriously to distort monthly book inventory figures.

Even when the above problems are not present, routine inventory cost information still may need tailoring before it can be used. Various combinations of cost, such as direct versus indirect, fixed versus variable, or materials versus labor versus burden, may be desired yet not be available from the accounts. Be-

yond this, it is also well-recognized that, for some purposes, special charges must be added or subtracted from book inventory figures to arrive at more realistic measures of, say, the full investment in a given part of the inventory. Standard cost systems are ordinarily designed to give normal costs in inventory, yet many inventory management studies are directed at the abnormal conditions. The effect of these abnormal conditions may be obscured in the variance accounts.

The problem here is largely one of accounting priority of objectives. Factory accountants have been charged primarily with the responsibility of providing good payroll and performance data and to do this cheaply. As the process has lent itself to mechanized accounting, it has been partly at the expense of improvements in other kinds of information which might be useful.

Economic Lot Analysis

It is very seldom that a company is lucky enough to find that its most effective production rate equals its rate of sales. Usually, some sort of lots or runs are necessary. Companies with wide product lines have an acute problem of this sort. Similarly, since most purchased parts can be obtained and transported more cheaply in large quantities, the same problem exists in almost any purchasing operation. The essence of analysis of economic lots is to find the size of order or production run which will minimize the total cost per piece of setup of ordering and inventory carrying charges. Most economic lot theory assumes constant variable cost per piece during the range of the analysis and simply attempts to minimize prorated order costs and costs of interest, storage, and obsolescence per piece.

Economic lot studies are, thus, a basic inventory and production planning tool. They have other important uses as well. Economic lot studies are basic to many kinds of equipment purchase studies, for the decision to use heavy equipment or automatic machinery should be made in the light of the best production lots on both the old and proposed machinery. Economic lot studies are useful in determining price policy and shipping schedules. The matter of balancing economies of long runs against dis-economies of storage is truly a pervasive problem.

There are several major cost accounting issues involved in economic lot studies. There is, first of all, the inventory-carrying-charge issue. This involves both the valuation problem which we have discussed, and interest. Unless a firm is operating at total capacity, it is usually desirable, from a theoretical standpoint, to deal with marginal costs in inventory values. Also, in many cases, the interest rate which is charged should be based on the opportunity cost of cap-

ital rather than some arbitrary figure which may have been set to discourage inventory investment. The determination of storage and obsolescence costs also involves some candid estimating. Floor space charges should be arrived at by analysis of alternative uses of space, not average charges. Obsolescence figures likewise need realistic treatment. The determination of inventory carrying charges for economic lot studies is thus a matter calling for resolution of serious accounting policy issues.

Occasionally, there may be revenue rather than cost considerations involved in economic lot studies. In companies which are operating at capacity, changes in inventory control procedure which will permit longer runs, may not only reduce costs but may also permit larger total sales. In firms with very slack production and inventory control systems, it sometimes happens that volume is seriously hampered by many change-overs for rush orders at times when the total capacity is most required.

Finally, there are cost accounting difficulties in obtaining good setup cost and production rate data. Production rate data should not include an averaging-in of setup cost, as is often the case. The costs of such indirect employees as machine adjusters are often included in production rate standards, so that setting forth precise production rates may be very difficult. Setup costs, similarly, should not only be separated from run cost data but separated from themselves. Often, setup data are so averaged out that they are of little value in studying the problems of individual machines in cases where partial setups and sequential setups are possible. Scrap losses involved in setting up should also be separated from scrap normal to running. Here again, normal accounting methods are inappropriate for inventory control analysis.

Systems Analysis

Little is known about how to measure the effectiveness of inventory or any other kind of control systems. At the same time, no one can deny the necessity for developing means to justify the overhead costs involved in maintaining one control system as opposed to another. A proposal to change an inventory control system should, theoretically, be prepared on the basis of a thorough breakdown of the cost of running the present system, the value it produces for the firm, and the reduction in cost, inventories, or improved manufacturing performance which will result from increasing the amount of clerical, tabulating, dispatching, or other kind of control personnel. It is difficult for firms to justify improvements in plant layout or in equipment unless it can be ascertained that these are being operated through the most effective control systems.

In this area, we have a major cost accounting problem and opportunity. The principal problem is that systems can be appraised only in the light of long-run costs. Thus for this purpose the standard distinctions between direct versus indirect and variable versus fixed costs are not very useful. Consider a switch from a process-centered manufacturing arrangement with decentralized foreman control and little by way of methods of production engineering assistance, to a line-production arrangement with centralized scheduling and extensive "preparation for manufacture." Instead of floor dispatchers, there may now be production planning clerks working in an office. Instead of all sorts of floor trouble-shooters and group leaders, there will be more production engineering and methods personnel. There might be little change in the direct versus indirect labor ratio, yet there would be a profound difference in the way the company is spending money.

Consideration of long-run costs also implies waiting in order to judge results. There may be a lag of several months or even a year, before a change in control procedure may be fully felt. There may be morale effects which are very hard to evaluate. Similarly, systems analysis should recognize the requirement for stand-by ability of the company to expand production quickly when it is needed. All these things are hard to measure precisely and, whatever measurement there is, must be on a long-run basis rather than on a short-run cost-volume-profit relationship basis.

New Quantitative Approaches to Inventory Analysis

Since World War II, new attacks have been made on business problems by way of rather elaborate analyses. One of these approaches is now quite well known as operations research and involves the application of certain scientific methods to business operations. In operations research, many tools of analysis are used. A discussion of them is beyond the scope of this paper, but some of the chief ones are mathematical models and probability concepts. To date, much of the success of operations research has been in the field of production planning and inventory control.

It should be pointed out, however, that operations research, along with other manufacturing analysis, requires information, and the difficulties experienced in getting and using inventory and other data are similar to the difficulties met in connection with other approaches to analysis. To illustrate, the informational needs of an operations research group working on an inventory control problem might involve extended series of data of a basic character, such as orders received, inventory, production, and shipments. Usually, there is less interest in

precision and completeness than in the fact that the data be basic and clear.

Also, operations research often involves the quantification of factors previously not evaluated. Suppose, for example, a study were undertaken to relate the costs of carrying inventories to the problem of losses in sales from being unable to service customers promptly. Some of the information needed would be quantity series regarding capacity, production, sales and delivery, as well as a damage function, in probability terms, of sales and customers lost from keeping customers waiting. Again, basic data about fixed costs, variable costs, and prices would be needed.

Another quantitative approach to the inventory and production control problem has become known as linear programming. It is a more specialized approach than operations research, because the latter refers to a point of view and a variety of techniques, whereas mathematical programming is a rather specific form of mathematical treatment. If our production planning organizations—given demand and capacity data—ever become able to work out equations which give them optimum quantities to make and the method of production to employ, they would be engaged in programming, perhaps linear programming.

Several high-quality studies involving mathematical programming have been made recently and it remains to be seen whether or not the methods can fulfill their promise and provide another tool for management guidance. If so, the cost accountant will again be called on, not only to provide information but to help use it in solving key problems of scheduling and balance in manufacturing.

Organizational Problems in Meeting Inventory Information Needs

As a result of their search for an adequate solution to the problem of inventory control, company managements have realized that part of the inventory control problem stems from the make-up of their internal organizations. In manufacturing companies, which we are principally discussing here, people specialize in the functions of purchasing, sales and merchandising, production and production planning, and accounting. Each of these groups assumes certain responsibilities for inventories and each needs different types of information concerning inventories and the products that pass through the inventory. The following outline illustrates these functional interests in inventory:

FUNCTION	TYPE OF INFORMATION
Production and production planning	Orders received Product specifications Materials available and required Work ahead

	Quantities produced Quantities in-process Quantities shipped or transferred Waste and spoilage Summaries of production costs
Purchasing	Available materials Product materials specifications Estimated requirements Materials costs and prices
Sales and merchandising	Orders received Finished goods quantities available Certain in-process and production data Costs for pricing purposes Shipments or transfers
Accounting	Often supplies much of the above information Details of costs Transfers from one process to another Orders received and shipments Inventory status

Although the foregoing classification of needs for inventory information is too brief to spell out the many differences of detail among the groups identified, it does not give an indication of both the similarity and the division of interests which has developed. Unfortunately, it is this very division of labor which has accentuated the differences between these parts of business organizations and, in the course of time, the gaps often widen so that coordination and cooperation become increasingly difficult.

When a division of labor such as this develops, it almost always brings with it a conflict of interest, which serves to aggravate the communication and coordination problems. Sales managers want more inventory. Accounting and financial managers want less inventory. Production planning managers try to satisfy both sides. The separate information which each uses sometimes makes it hard for them to agree on the facts, let alone the issues. Anyone who has had experience with inventory committees could readily attest to this point.

The Accountant's Opportunity to Aid in Inventory Management

Since the accounting profession has done so much work with inventories and because accountants usually bear the brunt of providing information about inventories, it is necessary to discuss their approach to inventories in more detail. This may serve to bring more understanding to those who complain that accounting groups cannot provide the information needed to solve problems of inventory management.

Inventory accounting or bookkeeping, is, in many respects, a prerequisite to income determination, and the determination of income has always been one of the central objectives of accounting. Since the advent of the Federal income tax law and the many other legal and public interest demands for profit reporting, the need for good accounting has increased. These demands, along with the effect of drastic price movements, have forced attention on inventories and have also given birth to such methods as cost or market, "lifo," and base stock.

The other objectives of accounting—such as planning, control, and internal audit check—likewise led the accountants to devote attention to inventories, and they have achieved much progress in these areas. In fact, a major part of the work of the public accountants has been in the inventory audit and inventory pricing field, and the literature of both internal and public auditing is replete with writings on inventory. Industrial accountants' work with inventories has been somewhat broader. A summary of their interest in inventories can be gleaned from the subjects taken up in the N.A.C.A. discussions forum outline on the subject, issued in 1952:

1. Controlling inventory size
2. Stock recording and inventory taking
3. Applying inventory costs against income
4. Federal income tax considerations
5. Problems in inventory prime costs
6. Including burden costs in inventories

However, even this listing indicates that the industrial accountant can perhaps be criticized for giving inadequate emphasis to the first and most important topic mentioned above; i.e., controlling inventory size. This is the key problem of inventory management. The accountant, charged with responsibility for the valuation and accountability phases of inventory work, has had little time left over to help out on the basic problems of inventory balance.

The analysis of inventory and production control problems is now an increasingly important management problem. Over the years, various analytical methods have been developed to aid in the many decisions which continuously need to be made regarding inventory size, capacity, production methods, production rates, and similar problems. Most of these methods of analyzing the inventory problem rely heavily upon accounting information. Hence, accountants have an opportunity to render an increasing service in this field.

The excellent progress which has been made in cost control has given industrial accounting increased responsibility in management, but much of the accounting information now being produced has weaknesses from the standpoint of inventory control. It is but a short step for industrial accountants to make better use of the analytical tools they have at their command. This would increase the scope of the profession's already major contribution to industrial management.

Seven-Segment Application of Plant Burden

by H. C. ARNOLD

Senior Methods Engineer, Comptroller's Division, Camera Works, Eastman Kodak Company, Rochester, New York

At once comprehensive, detailed and liberally illustrated, this paper portrays the particulars of burden application on a direct labor dollar base as practiced in a manufacturing plant of a large company, to determine burden center rates for application to products passing through the center. Experimental work and work related to the productive facilities, themselves, participate in the distribution of burden to a lesser degree than regular product work.

THIS STUDY IS A PORTRAYAL of a system used to accumulate and allocate factory overhead, which results in a reasonable degree of costing accuracy without excessive accounting detail. The data developed here applies to a typical small-parts manufacturing and assembly plant. The regular product line includes some two hundred sales items. The plant is operated under a well-established wage incentive plan covering production labor and a large segment of indirect labor, such as janitor service and plant maintenance work. The figures used to illustrate the article are not to be construed as actual amounts but have been developed to show a typical relationship to each other at a given production level and product mix.

The overhead rates in their final form are applied to the direct labor dollars required to manufacture the product. However, it will be seen that their development stems from several indices of activity other than that measured by the direct labor dollar. On any given part, however, there is a relationship between the number of labor dollars paid and the number of units produced. Technological improvements and wage rate changes may alter the basic number of dollars required to produce a part, but overhead rates are easily adjusted to compensate for these changes. As the direct labor content lowers, the burden rate may rise, but it is the final unit cost which counts. If increased burden does reflect technological progress, a low direct labor cost coupled with a high burden increment may well produce lower costs than a high direct labor cost coupled with a low burden increment.

First—The Total Picture

To serve as a reference in the explanation which follows, there is presented here a master chart displaying in summary form the various steps taken in the

Master Chart for Development of Regular Product Burden Rates

(FIGURES AS THOUSANDS)

EXHIBIT 1

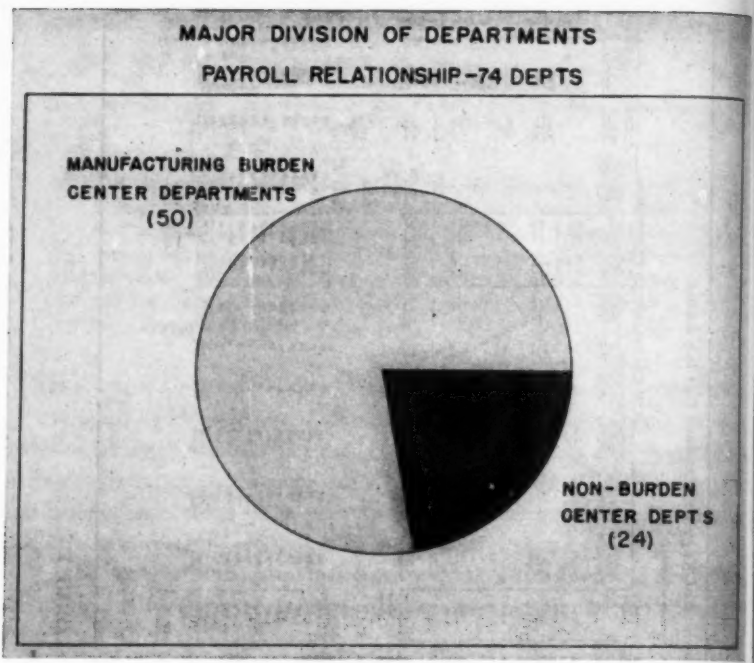

MAJOR DIVISION OF DEPARTMENTS
PAYROLL RELATIONSHIP–74 DEPTS
MANUFACTURING BURDEN CENTER DEPARTMENTS (50)
NON-BURDEN CENTER DEPTS (24)

EXHIBIT 2

development of a product burden rate. This is offered as Exhibit 1. It is designed to remain in view as the story progresses. It will be referred to as Exhibit 1 or as the master chart, as may seem suitable at the point at which the reference is made. The upper half of the chart shows the accumulation of labor and burden and the manner in which the burden is allocated to the manufacturing burden centers. The lower half of the chart shows the actual distribution by burden center of the amount listed in the upper section. The chart should be read from the center column entitled "plant burden." Here is shown the net accumulated burden totaling $17,383M. The direct labor rates shown in the adjoining column are for statistical purposes only and have no significance in the allocation of burden. The product rates shown below in the same column are the final results of the allocation. The columns to the right of the center list the various amounts broken up for distribution. The columns to the left under the caption, "productive labor," list the amount of labor charged directly to orders and jobs. It will be noted that there are three components of direct labor,

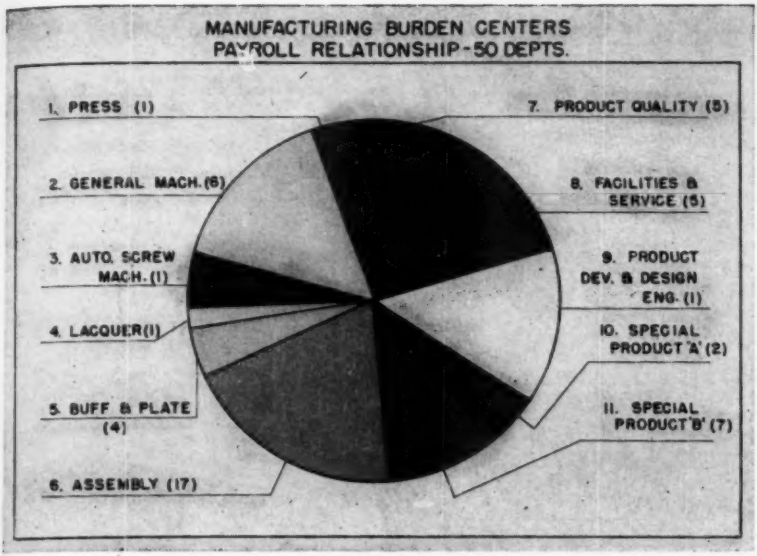

MANUFACTURING BURDEN CENTERS
PAYROLL RELATIONSHIP - 50 DEPTS.
1. PRESS (1)
2. GENERAL MACH. (6)
3. AUTO. SCREW MACH. (1)
4. LACQUER (1)
5. BUFF & PLATE (4)
6. ASSEMBLY (17)
7. PRODUCT QUALITY (5)
8. FACILITIES & SERVICE (5)
9. PRODUCT DEV. & DESIGN ENG. (1)
10. SPECIAL PRODUCT 'A' (2)
11. SPECIAL PRODUCT 'B' (7)

EXHIBIT 3

namely, product, facilities, and experimental. The type of labor shown as "jobs to burden" is classified as indirect labor, for such jobs are charged to burden accounts. It will be shown later how most of the burden items are first applied on productive labor and then adjusted for final application against product labor.

Underlying Departmentalization

In tracing the development of a burden rate, we begin with an examination of the plant organization. For administrative and control purposes, our subject plant is divided into seventy-four separate departments which have been grouped into two major divisions as shown in Exhibit 2. One division is known as the manufacturing burden center departments while the other division is referred to as the nonburden center departments. The chart shows the relative sizes of these divisions based on total payroll. Further on it is shown how the nonburden center segment is broken up and absorbed by the manufacturing segment.

The manufacturing burden center departments are portrayed in more detail in Exhibit 3. This chart shows the fifty manufacturing departments divided into eleven burden centers. A burden center may include a single department or a group of departments, as indicated by the numbers in parentheses. The com-

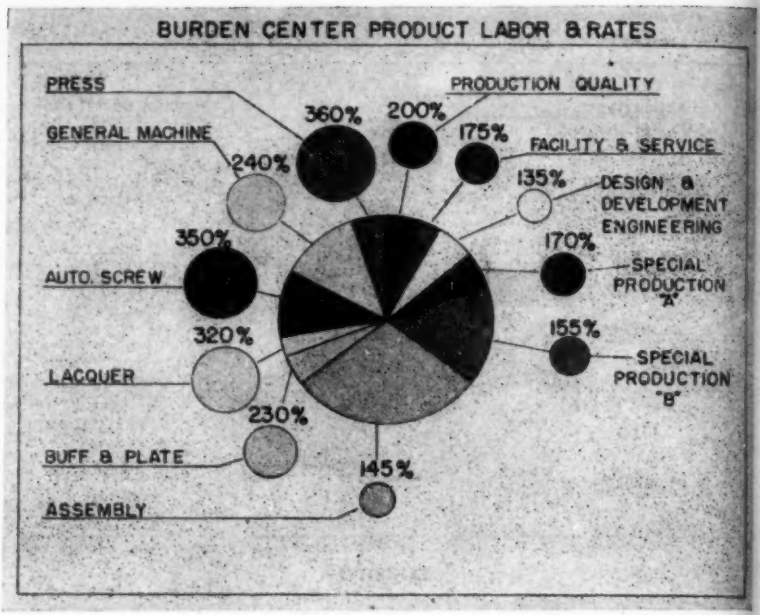


EXHIBIT 4

position of a department is dependent upon the functions and conditions involved. Like functions and like conditions are consolidated. The same is true with the composition of a burden center. Only departments with very similar operations are grouped together. Although the number of burden centers used to distribute burden is normally fixed over given periods, this is not a hard and fast arrangement. New departments and new burden centers are created whenever costing factors applied to the direct labor dollar will result in more accurate distribution by such a move.

An examination of the chart embodied in Exhibit 4 will reveal the relative amount of product labor expended by each center (segments of the inner circle) and each center's product burden rate relative in size to each other (satellites attached to segments). The figure identifying the rate also appears in the lower center section of the master chart. These results are shown here, as they were in Exhibit 1, to fix in mind the total picture. It can be seen that the amount of expense incurred during the expenditure of product labor dollars varies widely among the diverse functional centers. The overall product rate as shown on the

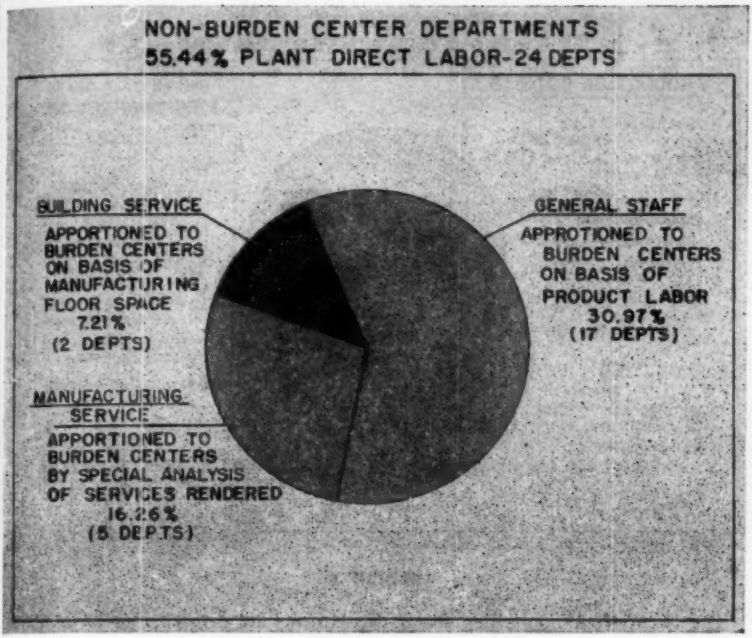


EXHIBIT 5

master chart is 198 per cent, but, burden-centerwise, the rates range from 135 per cent to 360 per cent, depending upon the relative weighting of the different factors in each. Thus, it would be a mere mathematical coincidence if any part as it progressed through the manufacturing process averaged 198 per cent burden. The amount of burden included in the cost of a finished product is dependent upon the type and length of operations in the various centers, which are involved in the manufacture of each part which goes to make up the product.

It may be interesting to note here that the major difference between the assembly department rate of 145 per cent and the lacquer department rate of 320 per cent is that, in the latter burden center, material is charged to one of its overhead accounts. There is a special reason for so treating material in this department. The net effect of the standard minute system used in the wage incentive plan is to create a direct correlation between the length of time the operator has the spray gun trained on the part and the amount of money he is paid. Hence the direct labor dollar serves as a convenient basis for the distribution of this type of material cost.

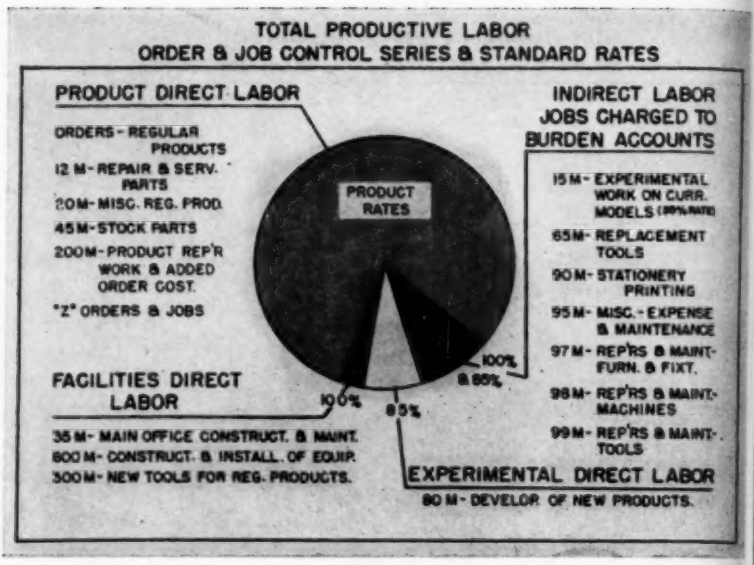

TOTAL PRODUCTIVE LABOR
ORDER & JOB CONTROL SERIES & STANDARD RATES
PRODUCT DIRECT LABOR
ORDERS - REGULAR PRODUCTS
12 M - REPAIR & SERV. PARTS
20M - MISC. REG. PROD.
45M - STOCK PARTS
200M - PRODUCT REP'R WORK & ADDED ORDER COST.
"Z" ORDERS & JOBS
PRODUCT RATES
INDIRECT LABOR JOBS CHARGED TO BURDEN ACCOUNTS
15M - EXPERIMENTAL WORK ON CURR. MODELS (80% RATE)
65M - REPLACEMENT TOOLS
90M - STATIONERY PRINTING
95M - MISC. - EXPENSE & MAINTENANCE
97M - REP'RS & MAINT. - FURN. & FIXT.
98M - REP'RS & MAINT. - MACHINES
99M - REP'RS & MAINT. - TOOLS
100%
& 85%
100%
85%
FACILITIES DIRECT LABOR
35 M - MAIN OFFICE CONSTRUCT. & MAINT.
600 M - CONSTRUCT. & INSTALL. OF EQUIP.
300M - NEW TOOLS FOR REG. PRODUCTS.
EXPERIMENTAL DIRECT LABOR
80 M - DEVELOP. OF NEW PRODUCTS.

EXHIBIT 6

The twenty-four nonburden center departments are divided into three major groups: building service, manufacturing service, and general staff. These are shown on Exhibit 5.

Classifications of Productive Labor

As mentioned earlier in the brief presentation of the master chart, the productive labor of a department may stem from any one or several major sources. Exhibit 6 shows the proportion of each type of labor to the total plant productive labor of $10,318M listed in the first column of Exhibit 1. As indicated by the title of Exhibit 6, all such labor is accumulated through orders and jobs.

The large segment of the circle in the center of Exhibit 6 represents $8,350M in the product direct labor column of the master chart. It includes all that labor which is expended directly against a particular end-product order or a job for a product part. This labor is controlled by a well-established wage incentive plan and is the final basis on which the product burden apportioned to the various centers is absorbed.

In addition to manufacturing products the plant constructs and installs new facilities. Such costs are collected on individual jobs and then charged to ca

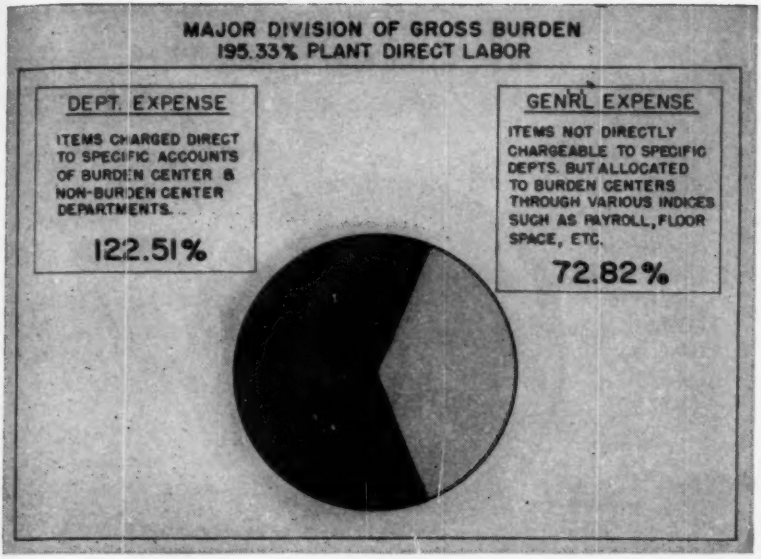

MAJOR DIVISION OF GROSS BURDEN
195.33% PLANT DIRECT LABOR
DEPT. EXPENSE
ITEMS CHARGED DIRECT TO SPECIFIC ACCOUNTS OF BURDEN CENTER & NON-BURDEN CENTER DEPARTMENTS.
122.51%
GENRL EXPENSE
ITEMS NOT DIRECTLY CHARGEABLE TO SPECIFIC DEPTS. BUT ALLOCATED TO BURDEN CENTERS THROUGH VARIOUS INDICES SUCH AS PAYROLL, FLOOR SPACE, ETC.
72.82%

EXHIBIT 7

ital asset accounts. The labor expended is, therefore, classified as direct. This portion of total productive labor amounts to $250M on the master chart, the bulk of which is expended in the facilities and service center as might be expected. It will be shown later how this type of labor carries a fixed burden rate of 100 per cent for purposes of capitalization.

The white segment in the circle Exhibit 6 represents the third type of direct labor. This is the labor expended in the development of new products. It totals $780M on the master chart. Again, it can be noted that the bulk of this labor is expended by one burden center known, in this case, as product development and design engineering. This type of labor also carries a fixed rate, 85 per cent, which will be explained later.

The three foregoing types of labor which total $9,380M on the master chart constitute the direct labor of the plant. This total serves as a basis for the statistical percentages shown in the Exhibit 1 column headed "burden rate, % direct labor." Again, it should be pointed out to avoid confusion that these rates have no significance in the distribution of the various burden items.

In addition to the direct labor classifications already mentioned, there is another segment of productive labor which appears on the master chart as "jobs to burden." In general, this labor is expended by one department performing

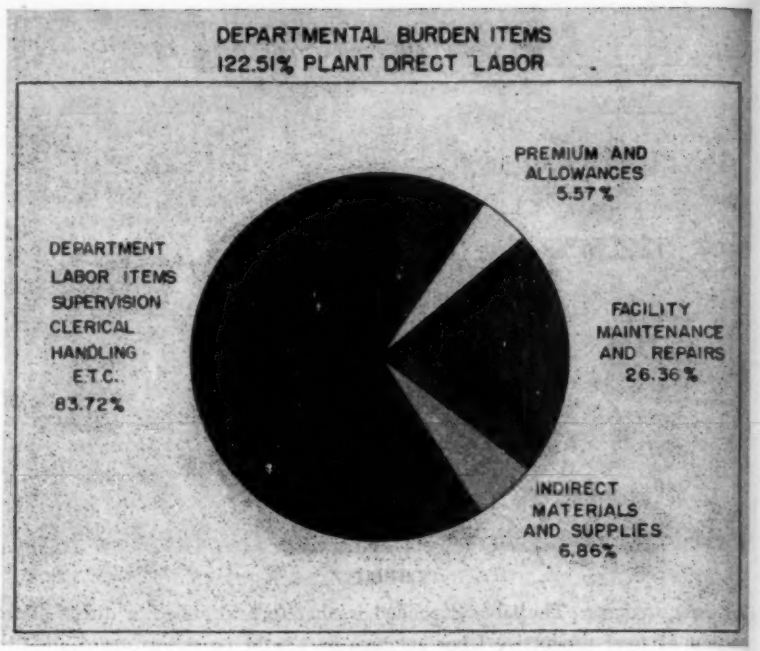

DEPARTMENTAL BURDEN ITEMS
122.51% PLANT DIRECT LABOR
PREMIUM AND ALLOWANCES 5.57%
DEPARTMENT LABOR ITEMS SUPERVISION CLERICAL HANDLING E.T.C. 83.72%
FACILITY MAINTENANCE AND REPAIRS 26.36%
INDIRECT MATERIALS AND SUPPLIES 6.86%

EXHIBIT 8

some service for another department. As far as the first department is concerned, it is productive labor but, for the department receiving the service, it is an expense, for such jobs are charged to departmental or general expense accounts. The master chart shows that the bulk of the $938M expenditure for this type of labor comes from the facilities and service burden center which include the plant maintenance, construction and tool departments. However, any of the departments might also do some service work for another department of a nature indicated by the job series shown on the labor chart.

These job series serve to transfer not only the labor cost of service work from one department to another but also the burden incident to this labor. If a department does its own service work, the labor charge is made directly to one of its own expense accounts without the addition of burden, inasmuch as no transfer between departments is involved.

Classifications of Burden

As expense occurs, it is accumulated under numerous accounts. Broadly, these

DEPARTMENTAL BURDEN

DEPARTMENT LABOR ITEMS		AMOUNT	COST PER $100.00 DIRECT LABOR
901	Handling, Errands, Trucking	429,312	4.58
902	Clerical	2,646,852	28.22
905	Misc. Design and Drafting	93,808	1.00
907	Janitors, Misc. Clean-up	302,432	9.22
908	Watchmen and Guards	128,128	1.37
909	Power Plant	23,790	.25
910	Elevator Operators	39,000	.42
913	Misc. Engineering	761,566	8.12
918	Supervision	2,438,059	25.99
919	Inspection	862,030	9.19
944	Misc. Indirect Labor	127,829	1.36
	Total	**7,852,806**	**83.72**
DEPT. PREMIUMS AND ALLOWANCES			
980	Trickwork Bonus	143,520	1.53
981	Overtime Premiums	67,860	.72
982	Lost Time	60,541	.65
983	Change Points	91,871	.98
984	Lunch Payments	6,240	.07
985	Make-up to Guar. Wages	152,230	1.62
	Total	**522,262**	**5.57**
DEPT. MAINTENANCE AND REPAIR			
916	Maint. & Repair Equipment	293,480	3.13
925	Maint. & Repair Machinery	425,550	4.54
930	Gen. & Com. Tools - Not Capt.	287,179	3.06
935	Replacement of Capital Tools	365,380	3.90
940	Maint. & Repair Tools	1,100,400	11.73
	Total	**2,471,989**	**26.36**
DEPT. MATERIALS AND SUPPLIES			
952	Photographic Supplies	54,550	.58
961	Lacquer, Varnish & Stain	65,875	.70
970	Misc. Indirect Materials	456,840	4.87
978	Machine Rentals	66,560	.71
	Total	**643,825**	**6.86**
Total Department Burden		**11,490,882**	**122.51**

EXHIBIT 9

accounts are gathered together into either departmental expense or general expense. Exhibit 7 shows how general and departmental burden share in the total. The departmental expense items of manufacturing departments present no problem of distribution, as they are charged directly to their specific burden centers. Exhibit 8 gives the proportionate importance of major categories of departmental burden items (totalling $11,491M in the upper center section of the master chart) which make up the whole. This relationship is on a total plant basis, and will vary widely between departments and, hence, between burden centers.

The detailed accounts which establish the proportionate relationships shown

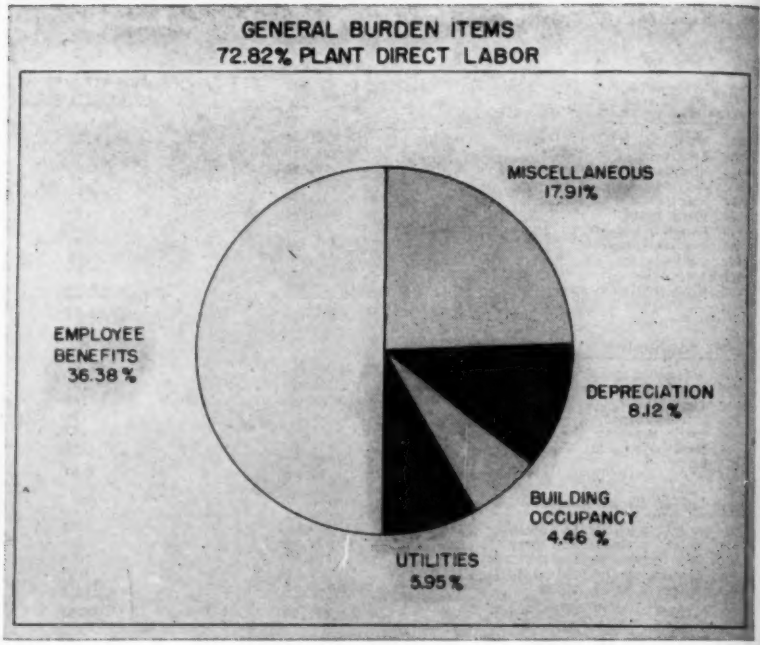
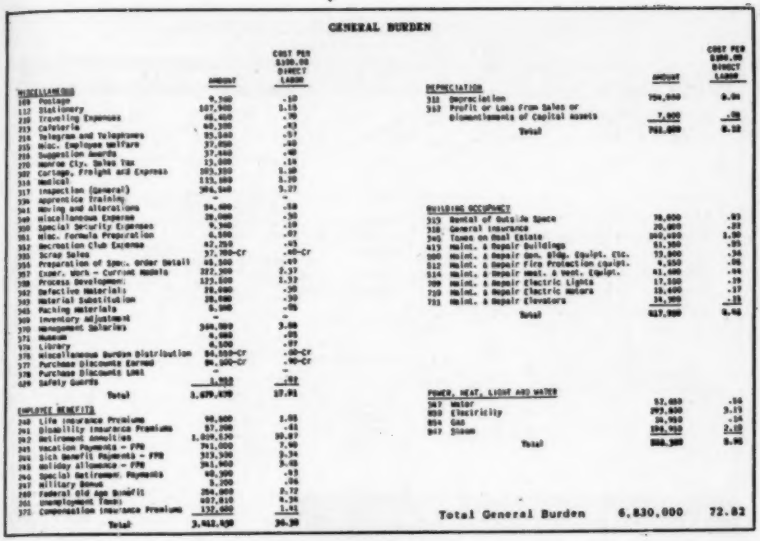


EXHIBIT 10

on Exhibit 8 are presented in Exhibit 9 to particularize the expenses which are charged directly to the individual departments. All departments, manufacturing and otherwise, employ an identical set of accounts, although some departments may not have charges in all accounts. As stated, there is no guesswork in the distribution of these expense items, since each charge is automatically assigned to a specific department upon occurrence.

General expense items are likewise grouped under several subheadings. It is interesting to note from Exhibit 10 that employee benefits account for fifty per cent of the total. Particular attention will be given to these expense groups as we follow their disposition to the burden centers, for nonburden center departmental expense and general expense items must be allocated to the burden centers through various indices. The total amounts can be seen in the upper section of the master chart and the detailed accounts are shown in Exhibit 11, which fills out the details of expense items. The totals of the various groups are listed in the lower half of the upper section of the master chart. The only ac-



GENERAL BURDEN

		AMOUNT	COST PER $100.00 DIRECT LABOR
MISCELLANEOUS			
109	Postage	9,760	.10
112	Stationery	107,960	1.15
210	Traveling Expenses	68,400	.70
213	Cafeteria	40,300	.43
214	Telegram and Telephones	55,540	.57
215	Misc. Employee Welfare	37,050	.40
216	Suggestion Awards	37,440	.40
270	Monroe City, Sales Tax	13,500	.14
307	Cartage, Freight and Express	203,350	1.10
310	Medical	115,980	1.20
317	Inspection (General)	504,540	5.27
324	Apprentice Training	-	-
341	Moving and Alterations	94,000	.98
349	Miscellaneous Expense	28,000	.30
350	Special Security Expenses	9,960	.10
351	Misc. Formula Preparation	6,500	.07
352	Recreation Club Expense	42,750	.45
353	Scrap Sales	37,700-Cr	.40-Cr
354	Preparation of Spec. Order Detail	48,500	.49
355	Exper. Work - Current Models	322,300	3.37
356	Process Development	223,800	2.32
357	Defective Materials	28,000	.30
362	Material Substitution	28,000	.30
363	Packing Materials	8,500	.09
369	Inventory Adjustment	-	-
370	Management Salaries	364,500	3.80
371	Museum	4,000	.05
376	Library	9,500	.07
376	Miscellaneous Burden Distribution	84,500-Cr	.90-Cr
377	Purchase Discounts Earned	84,500-Cr	.90-Cr
378	Purchase Discounts Lost	-	-
429	Safety Guards	1,950	.02
	Total	1,679,490	17.51
EMPLOYEE BENEFITS			
240	Life Insurance Premiums	48,600	1.01
241	Disability Insurance Premiums	37,200	.41
242	Retirement Annuities	1,029,630	10.87
243	Vacation Payments - PPB	741,000	7.96
244	Sick Benefit Payments - PPB	313,500	3.34
245	Holiday Allowance - PPB	341,900	3.61
246	Special Retirement Payments	48,300	.51
247	Military Bonus	3,200	.03
260	Federal Old Age Benefit	254,000	2.72
261	Unemployment Taxes	407,810	4.36
272	Compensation Insurance Premiums	137,600	1.41
	Total	3,442,450	36.39

		AMOUNT	COST PER $100.00 DIRECT LABOR
DEPRECIATION			
332	Depreciation	754,000	8.04
360	Profit or Loss from Sales or Dismantlements of Capital Assets	7,000	.08
	Total	761,000	8.12
BUILDING OCCUPANCY			
315	Rental of Outside Space	38,000	.43
318	General Insurance	20,000	.22
340	Taxes on Real Estate	240,000	2.50
419	Maint. & Repair Buildings	91,300	.95
500	Maint. & Repair Gen. Shop. Equipt. Etc.	33,000	.36
512	Maint. & Repair Fire Protection Equipt.	4,350	.06
516	Maint. & Repair Heat. & Vent. Equipt.	41,400	.44
709	Maint. & Repair Electric Lights	17,500	.19
710	Maint. & Repair Electric Motors	10,600	.17
721	Maint. & Repair Elevators	14,300	.15
	Total	517,900	5.46
POWER, HEAT, LIGHT AND WATER			
347	Water	12,000	.16
450	Electricity	297,600	3.15
854	Gas	24,900	.26
947	Steam	194,900	2.10
	Total	868,300	9.96
	Total General Burden	6,830,000	72.02

EXHIBIT 11

count included that has any direct departmental designation, is a portion of depreciation. This will be the subject of later comment.

How Burden Is Charged

The width of the columns in Exhibit 12 gives the relationship of the particular expense group to total plant burden. As a whole, the exhibit shows how burden is assembled for allocation under the two main divisions of department expense and general expense. The four subclassifications of department expense make up the total of $11,491M on the master chart, while the five subclassifications of general expense total $6,830M. In Exhibit 13 is shown the basis of allocation to the burden centers of the items assembled in Exhibit 12. Across the top are listed the seven categories of allocation into which the nine classifications of burden will be divided. Here, again, the relative width of the columns correspond to the figures listed in the upper right in the master chart.

Exhibit 14 constitutes a recapitulation of the previous two exhibits. The comparison is designed to show graphically how the assembled columns are broken up into allocation columns. The sections were originally drawn in color. Contrasts have been somewhat dimmed by the black-and-white reproduction. Nevertheless, the white column representing employee benefits and appearing in the left-hand section, can easily be compared with its divisions in the right-hand

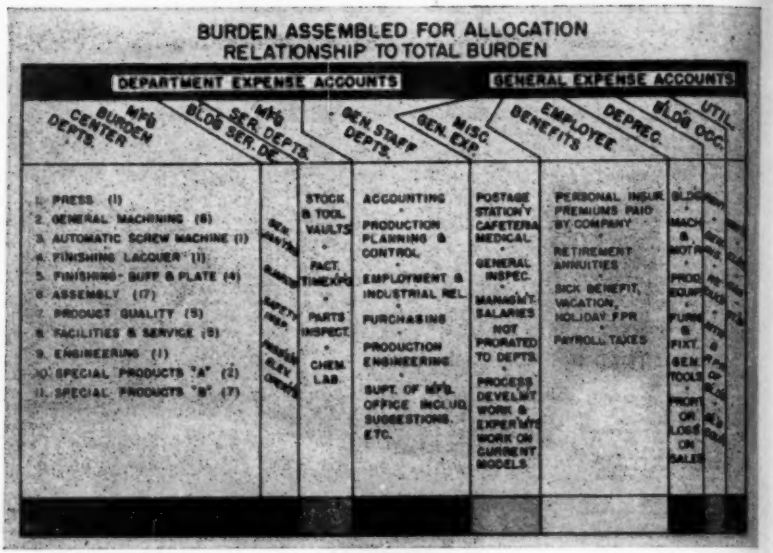


EXHIBIT 12

section. This expense is first prorated over the entire payroll of the plant. The portion allocated directly to the burden centers on the basis of their own payroll dollars is shown in the white column headed, "payroll" in the right-hand section and corresponds to the figure of $2,567M on the master chart. Under "floor space" is shown the portion which applies to the building service departments which, in turn, is represented by the shaded column directly to its left, having been transferred in its entirety from the assembled chart. In like manner, Exhibit 14 shows the amount of benefits applicable to the manufacturing service departments, which are distributed on the basis of services rendered. And, finally, it shows the portion applicable to general staff departments, which are apportioned on the basis of product labor. This four-way treatment of benefits can be seen in the breakdown to the right of the $3,413M figure on the master chart.

Example of the Press Room Rate: The First Three Segments

The remainder of this paper is devoted largely, although not exclusive of general comments, to the development of the 358 per cent burden rate for the press center, as illustrative of the development of other departmental rates. The Press Room is Burden Center No. 1. First of all, Exhibit 15 indicates the chief

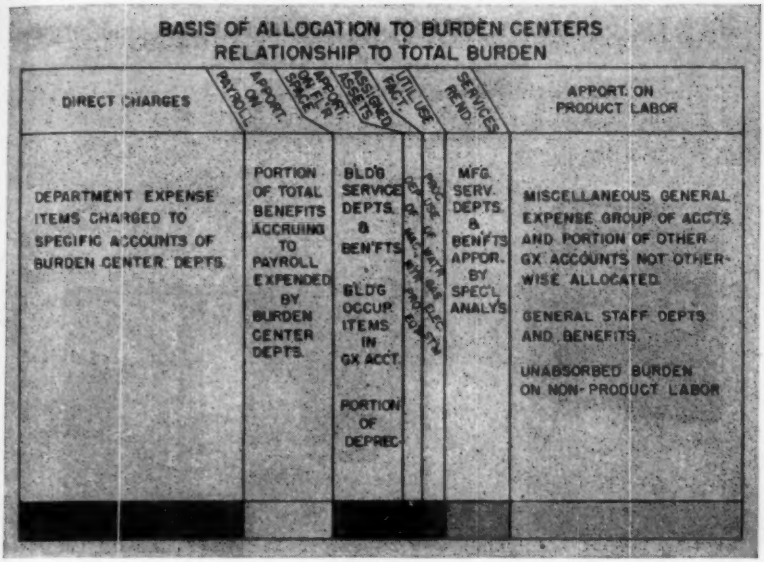

BASIS OF ALLOCATION TO BURDEN CENTERS
RELATIONSHIP TO TOTAL BURDEN
DIRECT CHARGES
APPORT. ON PAYROLL
APPORT. ON FLR. SPACE
APPORT. ON ASSIGNED ASSETS
UTIL. USE FACT.
SERVICES REND.
APPORT. ON PRODUCT LABOR
DEPARTMENT EXPENSE ITEMS CHARGED TO SPECIFIC ACCOUNTS OF BURDEN CENTER DEPTS.
PORTION OF TOTAL BENEFITS ACCRUING TO PAYROLL EXPENDED BY BURDEN CENTER DEPTS.
BLDG SERVICE DEPTS. & BEN'FTS.
BLDG OCCUP. ITEMS IN GX ACCT.
PORTION OF DEPREC.
MFG. SERV. DEPTS. & BENFTS APPOR. BY SPECL. ANALYS
MISCELLANEOUS GENERAL EXPENSE GROUP OF ACCTS. AND PORTION OF OTHER GX ACCOUNTS NOT OTHERWISE ALLOCATED
GENERAL STAFF DEPTS. AND BENEFITS
UNABSORBED BURDEN ON NON-PRODUCT LABOR

EXHIBIT 13

reason for this department being a separate burden center. It reveals the wide variation among centers in the magnitude and relationship of the separate items which are charged directly to departmental expense accounts, the first category of allocation. For example, it will be noted that facility maintenance and repair costs in this center amount to 124 per cent of its productive labor, as compared with 43 per cent in the general machining center and 7 per cent in the assembly center. Further, technological improvements in the press room will cause this rate to go even higher. As multiple die presses take the place of single die presses, less direct labor will be required, thereby reducing the base and raising the rate. Of course, these improvements will be undertaken to make the final total unit costs less, despite the fact that the overhead component will become more prominent.

The total expenses charged directly to burden centers amount to $6,385M. From the master chart, it will be seen that of this amount, $665M is charged directly to the press room, equivalent to a rate of 163 per cent on its productive labor. This dollar amount is shown in the first distribution column on the master chart to the right of the total plant burden column. At this point, we introduce Exhibit 16, as important in connection with the press room example as the master chart is to the burden rate picture as a whole. Exhibit 16 antici-

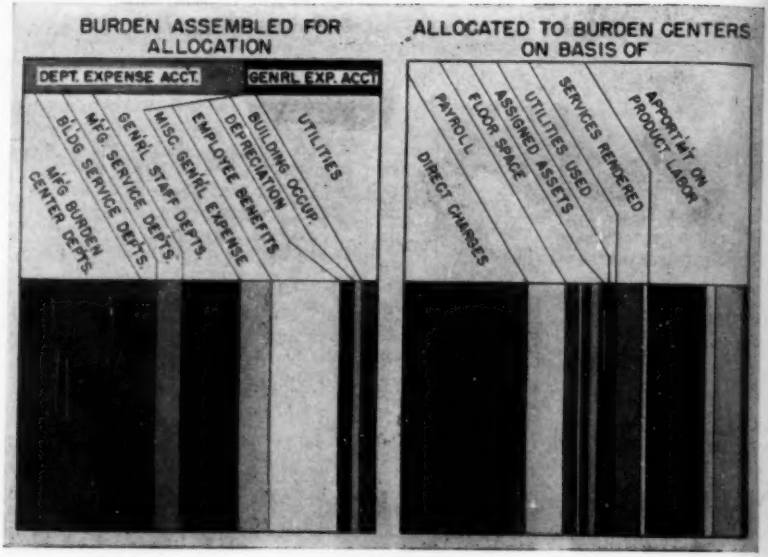


EXHIBIT 14

pates. It shows all segments of press room distribution. However, direct charges begin the process. Here we have the first segment in the buildup of the press burden rate. In this particular center, the expenses charged directly amount to about 46 per cent of the total rate. By definition, there is no problem of allocation with this type of expense. They belong wholly to the department.

The second step in the development of a burden center rate is the apportionment of the group of expenses, headed "employee benefits," totalling $3,413M on the master chart. As mentioned earlier, these expenses are apportioned on a payroll basis. The payroll in this plant is accumulated departmentally under two main portions and represents the total expended payroll of a department, irrespective of where it may be charged. The first portion of the accumulation covers hourly paid employees, while the second portion covers salaried employees. Of the eleven benefit accounts listed in the detail of general burden in Exhibit 11 three of them apply only to the hourly paid or factory payroll employees. These are vacation payments, sick benefit payments, and holiday allowances, which approximate 41 per cent of the total. These items are not segregated in the case of salaried employees. The remainder of the benefit detail applies to both hourly paid and salaried employees.

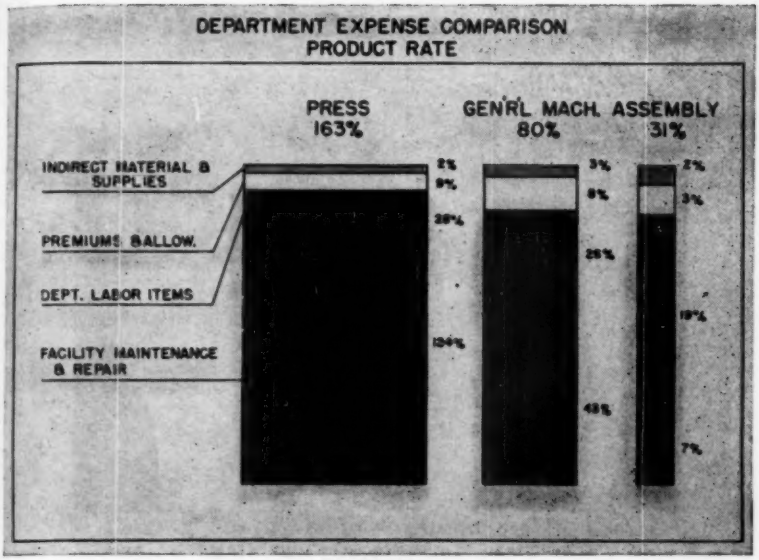


EXHIBIT 15

It is shown in Exhibit 17 how these benefits are apportioned to the four major groups of departments. All groups contain some hourly paid employees, as indicated by the factory payroll bar in the exhibit. This bar represents the distribution of the three accounts just mentioned as applicable only to hourly labor. The adjacent vertical bar gives the distribution of the remaining accounts on a total payroll basis. The right-hand section of the chart totals the two left-hand sections. Thus, the bottom portion of the right-hand section represents the total amount of benefits apportioned to the burden centers as a result of their own payroll. The amount is $2,567M on the master chart. The smaller, upper portions get to burden centers through nonburden center distributions. Thus, it will be seen, by reference back to Exhibit 16, that we have covered the second segment of the press burden rate, amounting to 28 per cent, and representing the employee benefits which accrue to the department's own payroll. The figure is $114M on the master chart.

The third segment is included within depreciation and makes it expedient to introduce discussion of this element as a whole. The depreciation portion of burden, totaling $762M on the master chart, is divided into three categories of allocation. The largest division on Exhibit 18 represents $455M and is part of the amount of expenses distributed to the centers on the basis of floor space

EXHIBIT 16

occupied. This includes depreciation on the buildings, building equipment, factory furniture and fixtures, air conditioning, movable partitions, etc., and is further dealt with later. The smallest of the three divisions of Exhibit 18 totaling $82M, represents the depreciation of miscellaneous general tools, and profit or loss on sale of assets. It becomes part of the expenses apportioned on a product labor basis. The middle-size division of the circle, representing $225M, stands for the depreciation of machinery, motors, and other production equipment. These assets are assigned to the individual departments using them, so that the depreciation can be specifically charged. This amount is listed under the assigned asset column on the master chart. The portion of depreciation specifically assigned in this way to the press center amounts to $36M. This is the third segment of the burden rate, adding another 9 per cent. Again, we can note the appearance of the figure on Exhibit 16.

Example of the Press Room: The Second Three Segments

The fourth segment of the burden charge relates to utilities. An ideal measurement of utilities consumed in operations would require the use of individual meters for each department. However, the expense of such a program, is not

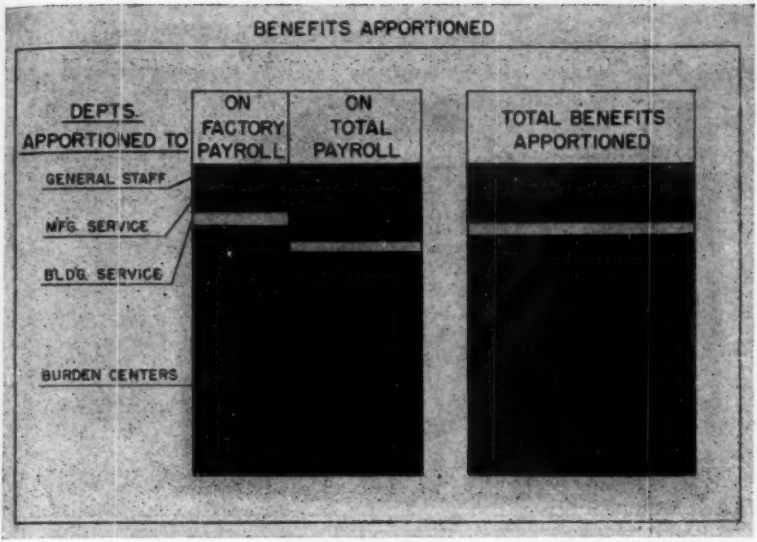


EXHIBIT 17

usually justified by the amount involved, nor is it in this case. The distribution of this item is predicated on detailed studies maintained by plant engineers, taking into account kilowatt hours, horsepower, load factors, etc. The small symbolic meters in Exhibit 19 show the distribution of the various utility items to each burden category. The large meter represents the total of $558M listed in the center section of the master chart. As a result of the engineering studies, utility cost in the amount of $20M is chargeable to the press room on the basis of use and supplies the fourth segment of burden cost, which adds 5 per cent to the rate, as Exhibit 16 indicates. This brings us to the fifth segment of burden, productive floor-space expenses, which, as applied to the press center, adds another 36 per cent to the rate. This can be followed on Exhibit 16. Expenses allocated to the burden centers on the basis of productive floor space used are portrayed in Exhibit 20 and include the portion of depreciation already mentioned. In fact, most of these expenses have been mentioned earlier in this paper. The vertical columns indicate the proportionate amount of each item charged to various production departments. The counterparts of these proportions, in figures, are listed under the heading "productive floor space" on the master chart. The horizontal subdivisions indicate the proportionate floor area occupied by the burden centers. The total expenses charged directly to building

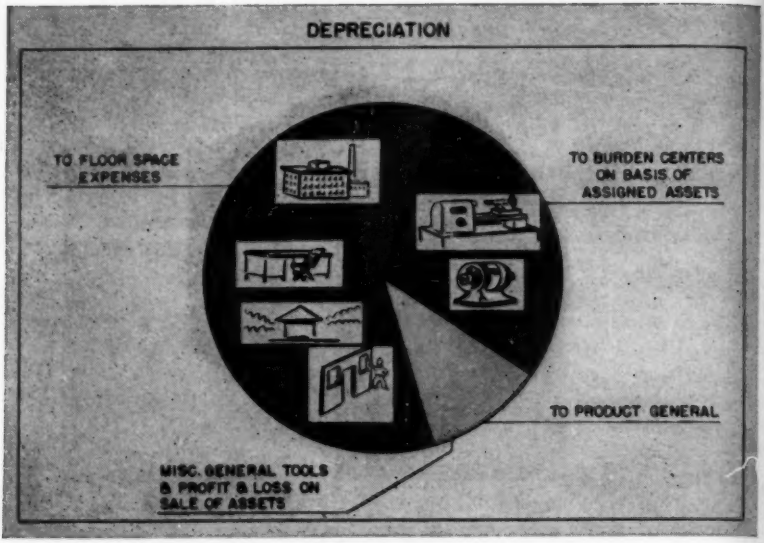

DEPRECIATION
TO FLOOR SPACE EXPENSES
TO BURDEN CENTERS ON BASIS OF ASSIGNED ASSETS
TO PRODUCT GENERAL
MISC. GENERAL TOOLS & PROFIT & LOSS ON SALE OF ASSETS

EXHIBIT 18

service departments, as well as the employee benefits accruing to their payroll, constitute the first two columns of the exhibit. The depreciation column is, in different picturization, the large sector from the pie chart on depreciation, which was offered in Exhibit 18, with promise of later comment. The next column represents the group of building occupancy items listed in the detail of general burden, totaling $418M. The final column of Exhibit 20 comes from the general building utility use factor, depicted in the large meter on the Exhibit 19. The total schedule, as seen on the master chart, amounts to $1,934M. The press department's share is $146M.

The sixth category of burden allocation concerns the expense of manufacturing service departments and their attendant employee benefits. The strip at the top of Exhibit 21 indicates the proportionate amounts of these items for the several departments. These services are centralized in these departments for the plant as a whole, although the personnel may be scattered. For example, the stock and tool vault department is made up of many vaults placed at strategic points but controlled under one operating head. The expense and benefits are apportioned to the burden centers on the basis of services rendered, generally measured in terms of number of personnel assigned. The service plates beneath the strip in Exhibit 21 show the results of analysis of services rendered. In the

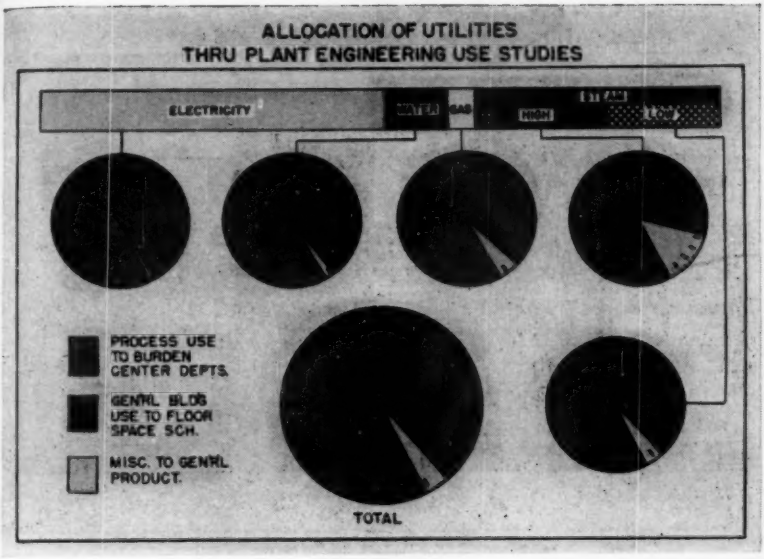


EXHIBIT 19

case of the chemical laboratory, stock and tool vaults, and factory timekeeping, all burden centers are involved in services rendered. However, parts quality A serves only three burden centers while parts quality C is limited to two. The addition of this sixth segment of burden, known as special services, increases the sample rate by 54 per cent and represents the $221M listed in the corresponding column of the master chart.

Fixed Overhead Rates for Certain Work

The total amount of burden allocated to the press center now amounts to $1,202M, which is equivalent to a rate of 294.61 per cent on the department's total productive labor of $408M. This allocated burden amount and rate appear opposite the departmental caption in the two subtotal columns (between vertical rules) near the extreme left of the master chart. Before applying the final segment of burden—apportioned on product labor only—certain adjustments are made to arrive at this base. Principally, there must be subtracted the labor for certain kinds of work not strictly processing and for which set overhead rates are used. In this connection, Exhibit 22 gives a comparative analysis

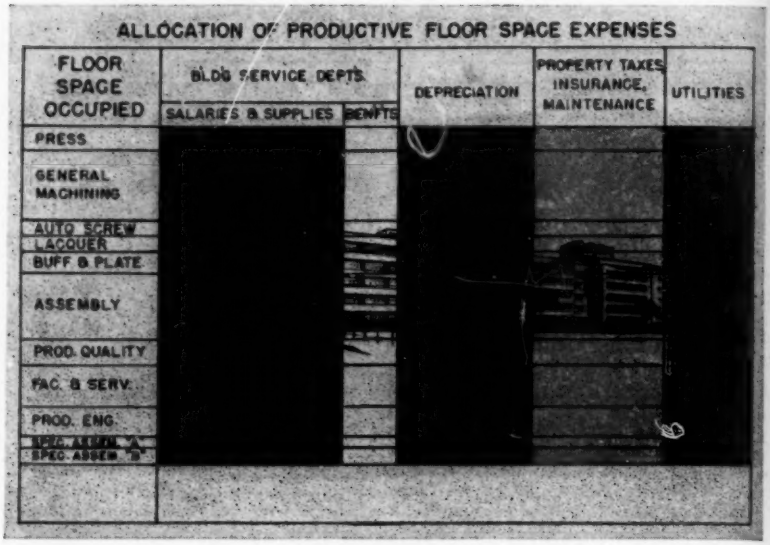


EXHIBIT 20

of total productive labor and its division among the burden centers. In general this division may be referred to as product labor and nonproduct labor. The latter covers experimental, facilities and "jobs to burden" labor identified at the start of this paper. As stated above and as noted earlier, for practical reasons management has authorized a fixed burden rate of 85 per cent to apply on all experimental work, and 100 per cent on facilities and jobs to burden.

These rates have been influenced by the productive labor rate of the burden center which is organized primarily for the expenditure of a given type of labor. For example, the pie charts in Exhibit 22 show the divisions of labor (coded below the pie charts) between the facilities and service center, the product development and design engineering center and all other burden centers. Any burden center may expend all four types of labor but, in general, the bulk of one type will be confined to a given center. Whereas, the facilities and engineering centers may produce some product work, as demonstrated in the first circle in Exhibit 22 (black section), the bulk of such work is produced in the other burden centers.

The second circle illustrates the fact that experimental work is practically confined to the engineering center, as might be expected. The master chart indicates that the burden applicable to the total productive labor of this Center

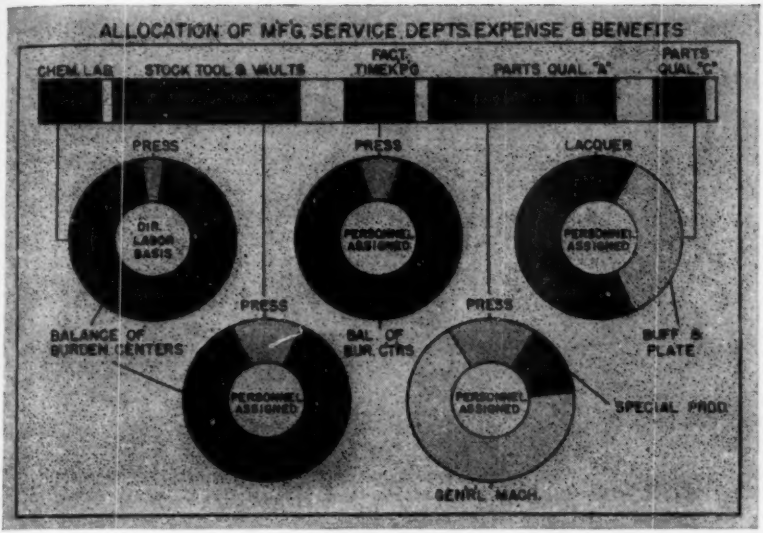


EXHIBIT 21

Number 9 produces a rate of 77.84 per cent. If this rate appears to be stable, the fixed rate of 85 per cent may well be lowered. Other centers may do experimental work, but they are not primarily designed to do so. Therefore, it has been determined that a standard rate for this work should apply to all centers. The same is true of facilities work. The third circle shows that over 90 per cent of this labor is expended within the facilities center. Here again, the fixed rate of 100 per cent is influenced by the 113.54 productive rate of Center Number 8 shown on the master chart.

It may be recalled that "jobs to burden labor" can be of a facilities nature, such as the repair and maintenance of machinery, tools and equipment, or of a product engineering nature, such as experimental work on current models. These jobs are charged to overhead accounts, both departmental and general. The greater part of such work is performed by the facility and engineering centers, as indicated in the fourth circle. Hence the respective rates are pegged at 100 per cent and 85 per cent.

The fixed burden rates for these several kinds of nonproduct labor do tend to result in absorption variances. In fact, one of the items in the schedule of general expenses—which are apportioned on product labor only, and which are dealt with in the next and final section of this article—is the variance between

EXHIBIT 22

the applied and actual burden on nonproduct labor. Reference to the master chart will show that the amount of burden applied to "jobs to burden" labor totals $938M, while experimental direct labor carries $663M and facilities direct labor accounts for $250M. This makes a grand total of $1,851M burden applied at pegged rates to nonproduct labor. The actual burden on this labor, as expended by each burden center, may be more or less than these pegged rates.

However, each center is credited with the actual amount of burden collected against its own nonproduct labor. This calculation can be seen in the column headed "actual burden on nonproduct labor" adjacent to the productive labor rates in the lower section of the master chart. In our example, the productive labor rate of 294.61 in the press center, multiplied by its $6M of nonproduct labor, gives the center a credit of $18M. Following this same calculation for the remainder of the centers, we find that the total actual burden is $1,948M. Since we have distributed only $1,851M at the pegged rates, $97M remains to be borne by product labor.

The Seventh Segment: General Product Expenses

This brings us to the final step in the development of a burden center rate—the apportionment of the remainder of expenses referred to as "product gen-

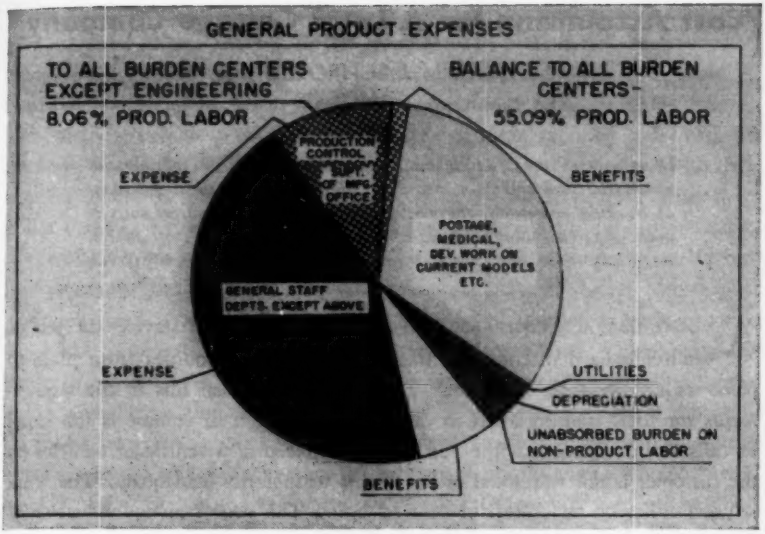


EXHIBIT 23

eral." Exhibit 23 displays the relative portions making up the totals which appear in the last two columns of the master chart. It will be noted that some product general items do not apply to all burden centers. For example, the expense and attendant benefits of the production planning and control department and superintendent of manufacturing office are not apportioned to the development and engineering center. However, all the remaining general staff departments apply to the product labor of all the centers. The other sections of the circle will be recognized from previous schedules showing the portion of various groups of expenses assigned to this category. The section entitled "unabsorbed burden on nonproduct labor" refers to the $97M variance above.

The total of $254M of general product expenses applied against the press center (arrived at by combining the figures for this center in the last two columns of the master chart) constitutes the seventh and final segment of factory cost and adds 63 per cent to its product rate. Thus, the picture is complete with a total of 358 per cent as shown in Exhibit 16. (Identical with 357.76 per cent, which appears in the product rate column at the center of the master chart.)

Cost Accounting For A Local Cartage Company

by WILLIAM J. SCHROEDER, JR.

Staff, Price Waterhouse & Co., New Orleans, La.

In this case study, which presents accounting aids to solutions of managerial problems in a specialized but generally interesting variant of trucking operations, the part played by attention to direct costs is made apparent. Major emphasis is given to the use of costs in setting rates to be charged to customers under different circumstances.

A LOCAL CARTAGE COMPANY PERFORMS, as its principal service, the job of individualized motor truck transportation of commodities from place to place within the same community. The local cartageman fills in the requirements for local transportation in cases in which the total volume is too small or calls so infrequent that the purchase and upkeep of a vehicle or vehicles by the customer is not warranted or his fleet is temporarily inadequate. The work is done either on an on-call or contract basis. The size of an individual shipment ranges from a single case to a thousand or more cases. The major types of work done are: general case goods movements, pool-car distribution, warehouse delivery service, railroad less-than-carload pickup and delivery service, and truck leasing on a per diem basis.

Direct labor, most frequently paid on an hourly basis, is the largest single item of expense in a local cartage company. Other important costs are truck maintenance and repairs, truck depreciation, and office and administrative expenses.

The following are a few examples of the major cost control figures which the cartageman can use:

1. The total hourly cost of operating a truck with or without its personnel (driver and helper(s)).
2. The percentage of available truck time utilized each day in productive activity.
3. The relationship of direct labor expenses to total expenses.
4. The costs of overtime.

These same figures are also taken into consideration when setting prices. Additional figures on variable and fixed costs per hour are also needed and are made available.

Cost Categories to Fit the Needs of Local Cartage Operations

The entire cost accounting system is built around the monthly profit and loss statement, which is prepared in accordance with direct cost theory, modified to

fit the particular needs of local cartage. A summary statement is used, supported by a marginal income analysis by job-groups as well as by detailed schedules of many of the expense items on the summary statement. Exhibits 1, 2, 3 and 4 comprise the set of monthly statements, with sample figures inserted. A review of these statements will indicate the type of items included under each of the main headings. All costs are classified according to the degree to which they respond to fluctuations in the volume of business (time consumed, rather than dollar value). Variable expenses include direct operating labor and the variable portion of the truck operating expenses. Fixed expenses include the usual overhead items, except that depreciation on the trucks is omitted.

An intermediate grouping or heading has been established to embrace costs which contain elements of both fixed and variable expenses. These items are the truck expenses (except for the variable operating portion), operating supervision, and the vacation allowances for direct labor employees. These expenses, known as semivariable expenses, are fixed when considering the individual unit (a single truck), but variable when considering the business as a whole. It will be evident that this group includes depreciation and the reader may well wonder why depreciation on the trucks, apparently a fixed item, has been included in the intermediate classification. A word of explanation is necessary, in order to explain the thinking behind the classification as a whole.

The basic reason for adding this intermediate classification is to treat the trucks as individual units, and not necessarily as a single asset. When management considers the purchase of this asset, the thinking may be in terms of one or a few trucks, rather than in terms of the entire fleet. The acquisition or disposition is on an individual unit basis and not on a group basis. The operating unit is one truck, worth about $3,000, not an entire plant costing some $300,000. Because of this situation, the emphasis is placed, not on the asset as a whole, but on the individual units in the asset. Each truck can, and frequently does, operate as an independent facility. Such is not usually the case with a manufacturing-type of plant, in which the separate departments are integrated and interdependent and must operate in conjunction with the rest of the plant. In effect, instead of one asset, the truck fleet represents many separate assets, all grouped under the single account title, "trucks," which serves to control the detail and to provide the figure for balance sheet and general ledger purposes, but is broken down for operating purposes into separate detail records on each truck.

Vacation expenses for the truck drivers and helpers are grouped with the truck expenses because they tend to be directly proportional to the number of trucks in operation. Hence, they also fall into the semivariable classification.

The Local Cartage Company, Inc.

PROFIT AND LOSS STATEMENT

January 195x

Sales			$14,835.20	100.0%
Less: Variable Operating Expenses (Exhibit 3)				
Direct Labor		$7,565.96		
Direct Truck Expense		841.61		
Total Variable Operating Expenses			8,407.57	56.7
Marginal Income			$ 6,427.63	43.3%
Less: Semi-Variable Expenses (Exhibit 3)				
Truck Expenses:				
Storage-Repairs-Licenses-Insurance	$ 947.99			
Depreciation	830.56			
Total Truck Expenses		$1,778.55		
Operating Supervision		1,254.52		
Vacation Allowances		134.10		
Total Semi-Variable Expenses			3,167.17	21.3
Operating Margin			$ 3,260.46	22.0%
Less: Fixed Expenses (Exhibit 4)				
Office Expenses		$ 734.93		
Selling Expenses		128.12		
Business Licenses & Taxes		92.50		
Administrative Expenses		1,133.14		
Miscellaneous Expenses		39.71		
Total Fixed Expenses			$ 2,128.40	14.3
Net Profit Before Income Taxes			$ 1,132.06	7.7%
Less: Federal Income Taxes			283.02	2.0
Net Profit After Income Taxes			$ 849.04	5.7%

EXHIBIT 1

Supervision parallels indirect labor in a manufacturing plant in its relation to volume, with one supervisor handling from six to ten trucks at a time and, is likewise semivariable.

In local cartage operations, the variable with the strongest effect upon costs, and profits, is time. The work is essentially a personal type of service, rendered to packages rather than to people. For this reason, the largest single item of cost is the hourly wage paid to the operating employees, i.e., the truck drivers and helpers. In direct contrast to the prime importance of efficient cost-per-mile operations to over-the-road trucking companies, costs-per-mile are relatively less important to the local trucker. Mileage in local trucking is comparatively low and costs which vary with miles travelled are less significant. Gasoline, repairs, and a mileage-based depreciation charge have little meaning in cost calculations

The Local Cartage Company, Inc.

MARGINAL INCOME ANALYSIS

January 195x

	TOTAL	B	D	M	R	T	W	MISCL.
Sales	$14,835.20	$ 385	$ 1581	$ 7569	$ 2819	$ 341	$ -0	$ 2140
Direct Labor	$ 7,565.42	$ 255	$ 1141	$ 3242	$ 1428	$ 289	$ 64	$ 1146
Adjustment	.54							1
Direct Truck	828.42	27	124	331	162	34	7	143
Adjustment	13.19							13
Total Direct	$ 8,407.57	$ 282	$ 1265	$ 3573	$ 1590	$ 323	$ 71	$ 1303
Marginal Income	$ 6,427.63	$ 103	$ 316	$ 3996	$ 1229	$ 18	($ 71)	$ 837
% Margin	43.3%	26.8	20.0	52.8	43.6	5.3	Loss	39.1

EXHIBIT 2

for the local cartageman. In their place are substituted the time calculations for direct labor, supervision, and time-based depreciation. Time becomes even more important when the direct cost method is adopted, because of the many calculations and estimates made when determining marginal incomes, estimated profits, and proposed prices. Since so much reliance is placed upon this information, accurate accounting for time is essential.

Mechanics of the Cost System

In order to compare incomes with the costs incurred, a system of cost accounting, resembling in many ways the customary job order cost system, has been devised. The work has been divided into classes or types, and each job-group has been assigned a code letter. Exhibit 5 shows some of the job-group code letters. Similar types of work are grouped together to simplify time reporting, cost analysis, and other clerical problems. Hence the term "job-group."

The costs are accumulated through the use of a Driver's Daily Record (Exhibit 6). This report is prepared each day by the supervisor to whom the driver is assigned and shows the work done by each driver and the time required to do each assignment. If a helper has been assigned to the truck, his time is reported also. The supervisor has a copy of the job-group code to help him break the time down into the proper codes.

When completed, the drivers' daily reports are turned into the office for costing and accumulation by job-group. A form for Office Cost Data (Exhibit 7) is used to calculate the charges applicable to the various job-groups, by

The Local Cartage Company, Inc.

VARIABLE AND SEMIVARIABLE EXPENSE

January 195x

Schedule 1

Variable Operating Expenses

Direct Labor:		
Drivers' Basic Earnings	$4,676.25	
Helpers' Basic Earnings	2,030.60	$6,706.85
Drivers' Premium Earnings	$ 192.51	
Helpers' Premium Earnings	106.15	298.66
Total Base Wages, Including Overtime Premium		$7,005.51
Payroll Taxes On Earnings		147.12
Workmen's Compensation Insurance (5.9%)		413.33
Total Direct Labor		$7,565.96
Direct Truck Expense:		
Gasoline And Motor Oils		$ 642.07
Tires And Tubes - New		112.23
Tires And Tubes - Repairs		56.12
Miscellaneous		31.19
Total Direct Truck Expense		$ 841.61

Schedule 2

Semi-Variable Expenses

Truck Expenses - Storage-Repairs-Licenses-Insurance:		
Storage, Washing, And Servicing		$ 276.00
Maintenance And Repairs		409.41
Insurance (BI, PD, F&T, Comprehensive)		224.25
Truck Licenses		38.33
Total Out-of-Pocket Truck Expenses		$ 947.99
Truck Depreciation		830.56
Total Truck Expenses		$ 1,778.55
Operating Supervision:		
Salaries Of Operating Supervisors	$ 900.00	
Payroll Taxes On Above Salaries	72.00	
Total Labor Cost Of Operating Supervisors		$ 972.00
Depreciation On Supervisors' Cars	$ 90.00	
Maintenance On Supervisors' Cars	36.48	
Operating Expenses	123.19	
Insurance On Supervisors' Cars	22.71	
Total Supervisors' Car Expenses		272.38
Miscellaneous Supervisors' Expenses		10.14
Total Operating Supervision		$ 1,254.52
Vacation Allowances - Drivers And Helpers		$ 134.10

EXHIBIT 3

truck. The job-group code letters and hours are checked and the hours charged against each job-group are extended at the actual labor rate, plus company payroll taxes and workmen's compensation insurance, to charge the job-group for employee time. Any overtime premium paid is set out as a separate item, to help in controlling excessive overtime. The charge for truck time is based upon the hourly truck variable costs for the preceding month, adjusted, as may be necessary, to reflect any estimated changes in costs (gasoline price increase, etc.). The method of arriving at this hourly rate will be subsequently discussed.

Profit Reporting and Analysis

A weekly profit and loss estimate (Exhibit 8) is used to provide up-to-date reporting on the profit-making progress of the company's operations. While called an estimate, this report is mathematically exact down to the total-marginal-income-for-the-week figure. Only the lower section of the report contains estimated figures. Each week the costs and incomes by job-groups are summarized for comparative purposes on this report. The figures given on the report are actual final figures for the week. The marginal income percentage is included to give management a basis of comparison among the different classes of work done during the week.

Budgeted semivariable expenses are determined by using the previous month's average per-hour semivariable costs multiplied by the actual hours for the week. Budgeted fixed expenses are estimated at one month's budgeted fixed expenses divided by 4.3 (the average number of weeks in a month). As can now be seen, the figure indicated as estimated net profit for the week (before income taxes) is a very useful index of the profit earned, considering the speed with which this report is made available to management.

In order to have all of the available truck time accounted for, several nonproductive and nonoperating code letters are established, against which the nonproductive and nonoperating time is charged. As indicated on Exhibit 5, code letter W is charged with the hours and cost of labor standing-by waiting to be assigned specific work. This job code is also charged with odd parts of an hour which cannot be utilized at the end of a work day. Code letter Y is charged with the hours (only) of a truck standing idle, with no driver, during regular working hours. Code letter Z is charged with the hours (only) that a truck is tied up being repaired or is "laid up" awaiting repairs.

Profit reporting and analyzing is rounded out and completed by two more important steps. The first step is the calculation of a daily truck utilization percentage, which is posted graphically, as in Exhibit 9. The information needed

The Local Cartage Company, Inc.

FIXED EXPENSES

January 195x

Fixed Expenses		
Office Expenses:		
Bookkeeper And Cashier	$ 300.00	
Typist And Billing Clerk	220.00	
Payroll Taxes	10.92	
Vacation Allowance	20.00	
Total Office Labor		$ 542.92
Stationery And Supplies	$ 26.41	
Postage	19.83	
Utilities (Gas, Electricity, Water)	21.80	
Telephone And Telegraph	42.16	
Cash Shortages (Petty Cash Fund)	None	
Total Office Operating Expenses		110.20
Depreciation On Furniture And Fixtures	$ 36.91	
Depreciation On Office Machines	28.42	
Repairs To Furniture	None	
Repairs To Office Machines	16.48	
Total Depreciation And Repairs		81.81
Total Office Expenses		$ 734.93
Selling Expenses:		
Advertising		$ 40.00
Entertainment		88.12
Total Selling Expenses		$ 128.12
Business Licenses And Taxes:		
Business License - State		$ 20.83
Business License - City		16.67
Business Property Taxes		35.00
Other Business Taxes		30.00
Total Business Licenses And Taxes		$ 92.50
Administrative Expenses:		
Manager's Salary	$ 500.00	
Assistant Manager's Salary	400.00	
Payroll Taxes	18.90	
Total Management Labor Cost		$ 918.90
Manager's Expense Account	$ 61.79	
Assistant Manager's Expense Account	16.95	
Dues And Subscriptions	12.50	
Donations	8.00	
Other Management Expenses		99.24
Auditing Fees	$ 80.00	
Legal Fees	35.00	
Total Professional Fees		115.00
Total Administrative Expenses		$1,133.14
Miscellaneous Expenses:		
Interest		$ 17.81
Other Miscellaneous		21.90
Total Miscellaneous Expenses		$ 39.71

EXHIBIT 4

The Local Cartage Company, Inc.

JOB-GROUP CODE LETTERS

January 195x

Chargeable Time

B - Warehouse delivery service - Jones Whse.
C - Warehouse delivery service - Adams Whse.
D - Warehouse delivery service - Miscellaneous
M - N. O. Tobacco Co. - Route delivery
R - Smith & Son Brokerage Co. - Pool-car distribution
S - Truck hourly rental - full rate
T - Truck hourly rental - reduced rate

V - Miscellaneous pickups and deliveries

Non-Productive Time

W - Truck stand-by time (Driver on duty)

Non-Operating Time

Y - Truck idle time (No driver on duty)
Z - Truck in repair shop

Note: Basis for Job-Groups - These jobs may be established on any basis which is desired by the company. The division could be by customer, by type of haul, by type of truck, or a combination. The exact set-up will depend on the size of the company and the need for detailed information.

EXHIBIT 5

for this graph is taken from the data accumulated on the various office cost data sheets (Exhibit 7), using only the total hours. Hours charged to nonproductive and nonoperating job-groups are segregated from hours charged to productive job-groups. In this manner, all truck time is accounted for each day and can be posted to the truck utilization percentage chart, which is Exhibit 9. This percentage is used to help management visualize the varying work-loads on the different days of the week and to determine the approximate average level of utilization of the trucks in productive activity. The object is to accept the greatest amount of profitable work with the smallest fleet necessary.

Two Reports for Management

The second step in the method of profit analysis is the preparation of several special management reports, each detailing a particular segment of the cost pic-

DRIVER'S DAILY RECORD

DATE 1-12-5X TRUCK NO. 45

DRIVER J. Moore HELPER H. Peters

FROM	TO	HOURS	WORKED ON	REMARKS
8:00	10:30	2½	250 cs. Short to X Wks.	
10:30	12:00	1½	100 cs. X Wkse - Route delay	2 stops
12:00	1:00	—	Lunch	
1:00	1:30	½	Standby	
1:30	6:00	4½	Y Whse route	14 stops

S.T. HOURS 8
O.T. HOURS 1

APPROVED: Wm J Schroeder Jr.
SUPERVISOR

EXHIBIT 6

ture. In this brief manuscript only two of the many possible reports will be discussed. The reader's imagination will suggest others which could be added to give a better picture of the company's operations. Of the pair to be described, the first is called Relation of Direct Costs to Fixed Costs (Exhibit 10). This report is used both in determining the efficiency of supervision over direct labor and in setting prices on new work. The focal figure is the percentage of overhead costs to variable operating costs.

In estimating the rate to be charged on new work, it is necessary to estimate the number of direct labor hours which will be required to handle the job. Using the known labor rates, plus direct labor burdens, plus truck variable operating costs per hour, the approximate variable cost of doing the job can be determined. The overhead to be applied is estimated by using the markup percentage indicated on the report, applied to the total direct costs. To this figure the amount of profit desired (including an allowance for income taxes) is added, to arrive at the total amount to be asked for the job. This rate is usually quoted in cents-per-hundredweight, which can be found by dividing the total weight to be handled by the total income to be charged.

Any increase in the overhead percentage should be carefully studied, to help prevent the build-up of an organization of supervisors and office employees in

excess of absolute requirements. A low overhead percentage (provided that adequate profits are still being earned) indicates that there is effective utilization of supervisory personnel, secured by distributing their attention over a wide group of operating employees. In order to get maximum information from the direct-to-fixed cost report, the figures may be plotted, month by month, on a graph, and become especially informative when the month-by-month changes are compared and any trends noted.

The other report, of the two selected for discussion here, is designated as An Analysis of Total Per-Hour Costs and Incomes (Exhibit 11). This report converts all cost figures of the business into per-hour costs. It gives an idea of the *average amount* which must be earned per hour of operation, without regard to changing conditions. The total drivers' hours (straight time plus overtime hours) are used as the total truck hours. (Industry custom usually discourages the leasing or using of a truck without its driver by cartage companies.) All costs are divided by these hours to arrive at the hourly costs. The hours indicated as standard are the total hours on normal working days during the month on an eight-hour day five-day week basis, less an allowance for normal maintenance down time.

This report contains several individual figures of special interest. One is the direct truck expense on an hourly basis. This is the rate at which truck hours are extended to arrive at truck variable costs on the office cost data worksheet which has been presented as Exhibit 7. Another figure is total semivariable costs per hour, which is used in estimating the semivariable costs for the weekly profit and loss estimate, which has been included as Exhibit 8.

In any analysis or estimating done using the per-hour figures for costs and incomes, the total hours used in calculating the hourly rates must always be considered. The average truck utilization percentage for that month is also quite important. It would be unwise to base decisions on an abnormal month's figures or to attempt to make comparisons among months of different levels of activity, because of the effect of the semivariable and fixed costs present in the figures. It will be remembered, in line with previous comment, that the semivariable costs are fixed by their nature, but variable in their degree of controllability. Months of operation at low utilization will tend to have higher unit costs than are normal, and vice versa for months of high utilization. Monthly comparisons of many of the figures developed by the two reports for management highlighted here (and other reports) are suggested, especially of the hourly rates and the percentages. These comparisons will give management a very good idea of the overall trend in costs, activity, and efficiency.

Overtime is controlled by the simple expedient of a memorandum supplement

OFFICE COST DATA

DATE 1-12-5X TRUCK NO. 45

HOURS USED	JOB CODE	TIME CHARGES				
		DRIV	HLPR	OT	LABR	TRUCK
2½	B	3.38	2.97	—	6.35	.56
1½	R	2.03	1.78	—	3.81	.34
½	W	.69	.59	—	1.26	.11
4½	R	6.08	5.35	1.27	12.70	1.01
9		12.16	10.69	1.27	24.12	2.02

EXHIBIT 7

to the weekly profit and loss estimate, which gives the amount of, and the reasons for, all overtime incurred. The explanation for any substantial amount of overtime is supplied by the supervisors at the bottom of the driver's daily reports.

Examples of the Use of the System in Price Setting

In order to show how the direct cost approach to pricing helps management in the cartage business, the following examples of normal price setting and of

WEEKLY PROFIT AND LOSS ESTIMATE

1-7 THRU 1-12 19[illegible]

JOB CODE	DESCRIPTION	GROSS INCOME	ST LABR	OT LABR	TRK	TOTAL DIRECT	MARGNL INCOME	%
B	Wharf pickups	128.47	84.19	—	8.83	93.02	35.45	27.6
D	Grocery routes	304.19	206.12	10.98	19.41	236.51	67.68	22.2
M	Meat-ice distribution	1997.36	819.41	41.83	100.36	961.57	1035.79	51.3
R	Warehouse deliveries	640.74	309.19	18.92	33.53	361.69	279.05	43.6
T	Miscellaneous pickups	53.42	51.23	.53	5.94	57.55	(4.13)	(7.7)
W	Stand-By Time	NONE	12.41	—	2.03	14.44	(14.44)	=
Mthly	=	483.42	262.07	—	35.49	297.56	185.86	38.4
	TOTALS	3585.10	1744.61	72.26	205.43	2022.34	1562.76	43.6

LESS:

BUDGETED SEMI-VARIABLE EXPENSES	$ 766.92	
BUDGETED FIXED EXPENSES	511.63	
	—	1278.55
ESTIMATED NET PROFIT FOR WEEK (BEFORE INCOME TAXES)		$ 284.19 7.9

EXHIBIT 8

setting a price under adverse and unprofitable conditions are given. An example showing the setting of a price quoted on a cents-per-hundredweight basis has been omitted because of the difficulty and length necessary to detail the various steps in estimating the direct labor hours required to do the work. It is esentially the same as price setting on an hourly basis, once the total number of direct labor hours has been estimated.

As to normal price setting on an hourly basis, suppose management wanted to prepare a schedule of hourly rental rates for trucks and drivers, sometime with helpers. The trucks might be used at any time of the normal working day.

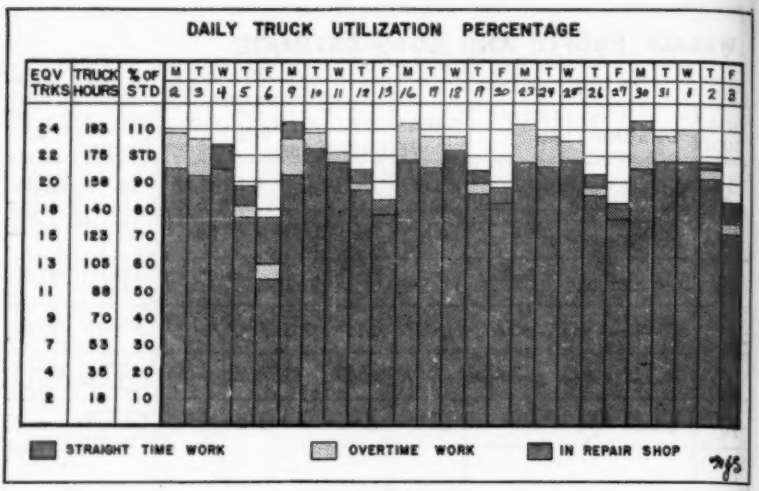

DAILY TRUCK UTILIZATION PERCENTAGE
EQV TRKS
TRUCK HOURS
% OF STD
M T W T F M T W T F M T W T F M T W T F M T W T F
Q 3 4 5 6 9 10 11 12 15 16 17 18 19 20 23 24 25 26 27 30 31 1 2 3
24 193 110
22 175 STD
20 158 90
18 140 80
15 123 70
13 105 60
11 88 50
9 70 40
7 53 30
4 35 20
2 18 10
STRAIGHT TIME WORK
OVERTIME WORK
IN REPAIR SHOP

EXHIBIT 9

The following hourly costs are taken from the current analysis of total per-hour costs and incomes described earlier (see Exhibit 11):

Truck direct expenses	22.5 cents per hour
Truck semivariable expenses	47.5 cents per hour
Vacation allowances	3.6 cents per hour
Fixed costs	56.9 cents per hour

The cost of operating supervision is omitted at this step, because it does not fully apply to trucks rented out. However, in figuring on business which would require supervision on the company's part, its cost would be included at the current hourly rate.

In addition to the above, the direct labor costs are:

Truck drivers	$1.35 per hour
Truck helpers	1.188 per hour

(These costs include company payroll taxes and workmen's compensation insurance.)

According to the above figures, total hourly costs are $2.655 with a driver only and $3.843 with both a driver and a helper. To these figures is added one-half of the hourly cost of operating supervision, since these costs remain even where it is not necessary to use the supervisors. (Of course, if a high enough proportion of the business were consistently done on a rental basis, some of the operating supervisors could be released.) The total hourly costs, including part

of the operating supervision, rise to $2.823 for the truck and driver only, and $4.011 for the truck, driver and one helper. The hourly costs are increased by the profit margin desired, plus an allowance for income taxes. The following rates are then quoted the customer:

Truck with driver only	$3.10 per hour
Truck with driver and helper	4.40 per hour

In considering the acceptance of low-revenue business, the daily truck utilization percentage must be available, either in numerical or in chart form, in order to accept such business without weakening the profit-making position of the company. Some accurate, factual idea of the availability of truck time is needed when evaluating the desirability of accepting business at less than the regular rates. For the present example, a chart (Exhibit 9) has been prepared showing the straight time, overtime and repair time for the entire fleet by days. As can be seen from the chart, the trucks are usually all busy on the first three days of the week, but there is some idleness on the last two days of each week.

Suppose that one of the customers requesting an hourly rental rate quotation had indicated that he would like to get a reduced rate and would be willing to use the trucks on off days to obtain it. A brief study of Exhibit 9 indicates that from six to thirty truck hours are available on Thursdays or from twenty-five to seventy truck hours are available on Fridays. The direct costs on a truck with a driver only can be determined, using Exhibit 11, so that the company will know whether or not the regular rate can be reduced so that this business can be quoted on. The following memorandum is worked up:

Truck driver's wages	$1.35 per hour
Truck variable expenses	.225 per hour
Minimum variable expenses	$1.575 per hour
Truck semivariable out-of-pocket	.253 per hour
Vacation allowances	.036 per hour
Suggested minimum to charge	$1.864 per hour
Unrecovered costs:	
Operating supervision	.336 per hour
Fixed costs	.569 per hour
Truck depreciation	.222 per hour
Total costs	$2.991 per hour

From these figures it is seen that almost any amount over $1.575 per hour would be better than letting the truck stand idle. However, the company would like to recover, as a minimum, the out-of-pocket costs incidental to operating the truck. Using the information in this memo, the daily truck utilization chart (Exhibit 9), and his personal knowledge of the situation, the company man-

The Local Cartage Company, Inc.

RELATION OF DIRECT COSTS TO FIXED COSTS

January 195x

	Amount	Percent of variable operating costs
Fixed costs	$ 2,128.40	25.3
Semivariable costs	3,167.17	37.7
Total overheads	$ 5,295.57	63.0 *
Variable operating costs	8,407.57	100.0
Total costs (except income tax)	$ 13,703.14	163.0
Income tax (estimated)	283.02	3.4
Total costs, including income tax	$ 13,986.16	166.4

* Focal figure - the percentage of overhead costs to variable operating costs (See text).

EXHIBIT 10

ager would be able to set a price low enough to be accepted, yet high enough to cover at least some of the semivariable and fixed costs. The customer could then be quoted the following prices:

For the use of one truck on a Thursday, or two trucks on a Friday, or more at the option of the cartage company, the following rates are quoted:

Truck, with driver only	$2.30 per hour
Truck, with driver and helper	3.50 per hour

All work is to be done during regular working hours. Additional trucks at these special rates are furnished at the option of the cartage company.

These rates may be withdrawn at any time, with twenty-four hours prior notice to the customer.

A minimum charge of one-half day's usage will apply.

Profit Margins on Various Classes of Work

As in many other businesses, the amount of total profit is dependent, to a considerable extent, upon obtaining the optimum job mix. Profit margins may vary considerably among the various classes of work. The customers demanding especially reliable service are usually willing to pay a little better rate. Some customers want extras and special attention, for which they also pay a premium. Certain types of work place more responsibility upon the local cartageman and he receives additional compensation for the acceptance of this responsibility.

In this connection, one of the features of the cost analysis system described

The Local Cartage Company, Inc.

ANALYSIS OF TOTAL PER-HOUR COSTS AND INCOMES

January 195x

	Total Costs	Hourly Costs	
		Actual Hours	Standard Hours
Variable Operating Expenses:			
Direct Labor	$ 7,565.96	$ 2.022	$ 2.022*
Direct Truck Expenses	841.61	.225	.225*
Total Variable Expenses	$ 8,407.57	$ 2.247	$ 2.247*
Semivariable Expenses:			
Truck Out-of-Pocket	$ 947.99	$ .253	$ .250
Truck Depreciation	830.56	.222	.219
Total Truck Expenses	$ 1,778.55	$ .475	$ .469
Operating Supervision	1,254.52	.336	.331
Vacation Allowances	134.10	.036	.035
Total Semivariables	$ 3,167.17	$ .847	$ .835
Fixed Costs:	$ 2,128.40	$ .569	$ .561
Total Costs, before taxes	$ 13,703.14	$ 3.663	$ 3.643*
Estimated income taxes	283.02	.076	.075
Total Costs:	$ 13,986.16	$ 3.739	$ 3.718*
NET PROFIT FOR THE MONTH	849.04	.227	.224
Sales:	$ 14,835.20	$ 3.966	$ 3.942*
Hours Used in Calculations		3741	3795

*Includes variable expenses based upon actual hours.

EXHIBIT 11

is the monthly determination of the average marginal income by job-group. Exhibit 2, with its monthly marginal income analysis, indicates the varying margins on the several classes of work. As can readily be seen by referring to the sample statement, job-groups "M" (N. O. Tobacco Co. route deliveries) and "R" (Smith & Son Brokerage Co. pool-car distribution) are the two most profitable types of work. Thus, management is enabled to direct attention to handling these classes of work first and to attempt to secure additional similar work.

Problems and Possibilities

Cost information cannot guarantee that the company will be able to cover these costs by charging the rates indicated by the analysis. Still, the time and effort would be well spent in learning how far a company could go in cutting prices to meet competition and still stay in business. Accurate cost accounting information provides a firm and fair basis upon which to estimate prices and prevents taking the proverbial "shot in the dark."

Another serious problem in local cartage cost accounting is joint costs. Frequently, a truck will work on several different job-groups at one time, representing a managerial effort to cut costs by eliminating back-tracking and duplication of waiting time. In such cases, the total costs among the job-groups involved would be allocated as accurately as may be practicable under the circumstances.

It is the author's belief that the adoption of direct cost principles in cost analysis and price-setting for local cartage companies results in a fairer allocation of costs, by job-group, to the incomes which they help to produce. Rates may be set more in line with the actual costs of rendering the services. Estimates of the costs of new work proposed to be done should then be more in line with the actual costs which will be later incurred. The marginal income approach by job-group should be especially useful in squeezing dollars out of idle time, in many cases, and in raising the overall company profit through the acceptance of business which formerly would have been declined. This would be accomplished without sacrificing the company's ability to handle the more profitable business, when available.

This paper was written from material gathered prior to the writer's employment by Price Waterhouse & Co., and is entirely an expression of his own opinions.

A Report on Five Years of Profit-Sharing

by JOSEPH M. NAAB

Vice President and Treasurer, Leslie Co., Lyndhurst, New Jersey

Both a current-payment incentive plan (which has a still longer history) and a deferred-payment retirement plan more particularly dealt with in this article, are in operation in the author's company. It is indicated that the exceptional results obtained are normal for well-devised plans adopted by an incentive-minded management.

OUR DYNAMIC AMERICAN ECONOMY is characterized by a never-ending search for new ideas which will lead to greater production at lower cost. Certain fundamental principles must be acknowledged as forming the firm foundation upon which our free enterprise system thrives, and without which it could not survive. Among them are the following:

1. Business is entitled to a fair profit as a return upon its investment.
2. Labor is worthy of its hire, and reasonable incentives to increase workers' productivity and their earning capacity are essential to business progress.
3. Management and labor must cooperate fully and fairly to achieve good output, quality of products, with resulting confidence of customers and repetition of orders.
4. The health and security of its employees is an inescapable responsibility of management, which must be effectively discharged.

Management is Of, For, and By Individuals

The degree of success which any business achieves is readily measurable by the extent to which it understands and accepts the opportunities and responsibilities suggested in the foregoing brief resume of business ideals. In the triumvirate of management, labor, and capital, which are the key factors in our prosperity, each has an equally important function to perform.

The most unpredictable factor is labor, and very naturally so, because of the varying and variable personality and individuality of each living being which is a part of it. Psychologists tells us that no man ordinarily develops more than fifty per cent of his latent ability without some powerful motivating stimulant. We call this the incentive which develops in the workers the initiative for efficient operation. People—the men and women of industry—therefore continue to be the biggest potential value in any business. Their inherent maximum worth still remains an unknown quantity, unexplored and incalculable. Their development will bring about the great progress of the future because "the possibilities of man are unlimited." (*Incentive Management*, J. F. Lincoln, Lincoln Electric Co., Cleveland 17, Ohio, 1951)

Good management has earned its rating during our generation principally by the measure of success it has enjoyed in improving employee productivity through well-designed, mutually satisfactory incentive plans. Such plans are successful only to the extent that the workers whole-heartedly accept the challenge and spontaneously respond with a voluntary desire to improve their production. Singularly enough, many well-intentioned incentive plans, initiated with high promise of fruitful improvement in effort and output, have enjoyed but limited and short-lived existence in large numbers of business establishments, mostly for reasons all too well known to cost accountants. Passing mention might be made here of such abuses as lack of care, reasonableness, and accuracy in setting standards; unfair adjustments and "corrections" arbitrarily reducing the earning of the workers; selfish, arrogant, and picayune attitudes of supervisors toward employees, etc.

First—A Satisfactory Current-Payment Incentive Plan

Because we have just completed five years' operation of a deferred-payment profit-sharing plan, it is believed that our company's experience will supply some impressive facts and figures as to improved results attributable to such a plan. To begin with, it is our conviction that there should first be a basic wage incentive plan, measuring production against standards, and rewarding the workers for premium performance, as a fundamental requirement for increasing output and reducing unit costs. We also believe that such a plan, tailored to the particular needs of the individual business, should seek to promote team-work among all employees and with management and, therefore, should reward supervisory employees and indirect and clerical labor, as well as direct productive labor, on comparable terms, always commensurate with contribution to the overall results. To this end we set up supervisory, clerical, and indirect labor standard ratios and budgets, based upon direct labor production and we pay a premium or weekly incentive bonus for efficiency achieved.

Most managements which reach this point stop at it and say that this is enough sharing of profits. We feel it is only the beginning. By making all grades of workers and supervisors (short only of top management officials) sharers in the weekly wage incentive bonus, we have established a base from which to develop real cost savings. Only imagination and vision of management are necessary to project the possible further production gains and cost savings into the category of the miraculous. Our incentive bonus payments increased from 5 per cent to 25 per cent in the first two years and went to 40 per cent by the end of the fifth year of the plan. It was then generally felt that this

was a maximum attainable in this way, so we proposed, at this point, that the additional profits resulting from the incentive production be further shared with our employees by paying 15 per cent of all profits before taxes (after a nominal contingency reserve and a standard dividend payment) into an employees' profit sharing and retirement fund.

Setting Up the Profit-Sharing Retirement Plan

Up to this time, in December, 1948, we did not have a retirement plan as such, nor had we set aside funds for the retirement or pensioning of incapacitated and/or old age employees. It had been our policy to carry retired employees on a current pension payroll as part of general overhead costs. The amount paid to each individual was, in each case, decided upon its merits—full consideration being given to the length of service, positions held, and special needs of the retiring employee. In most cases the allowance paid approximated the amount of money the pensioner would be eligible to receive through government social security benefits.

However, there had been for some time the realization of the need for a sound, yet more generous, pension plan which would provide a reasonable and fair competence for the employee in old age, as a reward for long-time faithful service. About 1946, management had decided to meet its obligation in this respect as soon as possible. An intensive study of various types of pension retirement plans followed. We were necessarily committed to a conservative working capital policy, due to substantial shrinkage in post-war sales volume and resulting need for an aggressive new product development program to effect an early recovery of lost volume. The prospective burden of heavy fixed charges resulting from a combination of a large annual insurance premium or annuity cost and funding of past service credit for employees with a long service record, loomed as a large and insurmountable obstacle. A deferred-payment profit-sharing plan alone seemed to offer a practical solution. Our efforts went into formulating a plan of this type.

Highlights of the resulting plan, called "Employees' Profit-Sharing and Retirement Fund of Leslie Co." and unanimously accepted by all those eligible, were:

1. **Annual contribution by the company of 15 per cent (later increased to 25 per cent) of its profits before taxes, after provisions for a nominal contingency reserve and a dividend of one dollar per share on outstanding common stock.**
2. **A current contribution by employees,**
5. **Company contributions and fund earnings allocated to members on a point system—two points for each year of continuous service and one point for each $100 of gross pay or earnings per year, up to a maximum of $10,000 annual income.**

through payroll deductions, of 3 per cent of their earnings up to a maximum payment of $300 per annum.

3. All payments under the plan to be accumulated in a trust fund managed by an advisory committee consisting of the company president as irrevocable trustee and two representatives each of management (appointed by the company's board of directors) and of employees (elected by the majority of all members of the plan).
4. Advisory board members to serve two years, beginning on alternate anniversaries of organization date.
6. Participants' shares subject to vesting at the rate of 5 per cent per year, thus insuring 100 per cent irrevocable interest after twenty years.
7. Retirement age set at 65 years but further employment and sharing of profits beyond that age optional if the employee is able and willing to continue working. Upon retirement, the employee's interest in the fund is paid either in a lump sum or in periodic installments, as mutually agreed upon at the option of the advisory board.

To accentuate the fact that a new profit-sharing plan had been born, the company made its initial contribution in December, 1948, for the full amount due for that year, even though employee contributions were not begun until January 1, 1949. The results of this action were electrifying. The entire body of employees sensed a new bond of interest in their business. They had a real stake in the future of the company for which they were working. The initial contribution of the company was their exclusive share in the past year's profits and they indicated very frankly their hope and intent of making this a sizeable, worthwhile "cushion" for the future day of retirement.

For the first time, the employees gave evidence of feeling that, at last, they had become partners with management in a business to which they belonged and in which they had a real interest. The employees became truly profit conscious, which really means cost conscious. They immediately set about to do their part in avoiding waste, improving efficiency, and reducing all elements of cost. It was in the second year of operation of the employees' profit sharing retirement fund that the share of profits contributed annually by the company was increased from 15 per cent to 25 per cent, subject to the same conditions as at the initiation of the plan.

What Profit-Sharing Has Done in Our Company

The first question that naturally arises, with regard to such an important innovation in any business, is whether or not the results have justified the company's action, i.e., whether or not the company has been sufficiently benefited to warrant the generosity of its contributions for the future well-being of its employees. The answer is unconditionally affirmative. Critical appraisal of the facts which follow may well be convincing, taking them as forming a single picture:

1. Annual sales increased 80 per cent from 1948 to 1952.

2. Number of employees increased only 43 per cent during the same period, indicating an increase of 26 per cent in dollar-value output per employee.

3. Individual employee productivity improved progressively from year to year, as measured against time-study standards for calculation of weekly incentive bonus paid. From an average annual rate of 40.5 per cent in 1948, this incentive bonus increased to 43.8 per cent in 1950 and reached an all-time high of 54 per cent in 1953. These results actually produced a 12 per cent increased employee productivity from 1948 to 1950, and a 48 per cent increase at maximum productivity rate in 1953 over 1948.

4. Extensive savings in material costs resulted directly from profit-sharing. Not only were scrap and waste reduced because of the greater attention paid to these elements by the workers but, also, when made aware of the cost of these items for the first time, workers often came up with surprisingly effective suggestions to reduce the cost and use of materials.

5. In five years, approximately $315,000 in contributions was paid by the company into the profit-sharing retirement fund, resulting in approximately $165,000 of Federal income tax savings to the company.

6. A satisfactory rate of net profit after all payments and income taxes has been realized by management in each of the five years of operation under profit-sharing.

Equally remarkable are the statistics as to the relative value or share of the fund credited to the participating employees. For every dollar paid into the fund by employees, the company has contributed $2.25. The fund has earned from 5 per cent to 6 per cent annually in income from investments, relinquishments by employees withdrawing from the fund, etc. Average equity in the fund per member has grown from $158 in 1948 to more than $2,200 in five years, an increase of nearly 1300 per cent. The total value of the fund has mounted to nearly half a million dollars. The psychological aspect of this rapidly pyramiding nest egg of soundly-invested dollars is incalculable. Every last employee with a share in it eagerly awaits the periodic progress reports and sees his future security improving rapidly with every day of continuing effort on his part. He is spurred on to do his best in the common interest of the company, with all his fellow workers. Moreover, the continuing increase in the individual employee's equity has resulted in a new appreciation of the value of thrift. He has now learned how to apply the compound interest table to the annual increase in his portion of the profit-sharing fund. Here is an example of what the future holds for John Jones, age 25, in this type of deferred-payment profit-sharing. If $1 a year is put aside in a fund earning income of four per cent (ours has been earning five per cent to six per cent) there will be on hand:

$12.00 after 10 years
$20.02 after 15 years
$29.77 after 20 years
$41.64 after 25 years
$56.08 after 30 years
$73.65 after 35 years
$95.02 after 40 years

About $400 a year put aside for Jones will entitle him at retirement age of 65 years, to 400 times $95.02 or $38,008. This is a conservative example.

Obviously, with such results directly attributable to profit-sharing, there are many specific related problems solved for management or completely erased from its slate, as for example:

1. Employee turnover is minimized. There are very few avoidable severances.
2. Absenteeism and tardiness are practically nonexistent.
3. Employee attitude is one of interest in job, personal contentment, cooperative friendliness, and general good will. All these are potent factors toward better production and team-work throughout the plant.
4. Relationship between departments is in terms of friendly competition and team-work, rather than jealousy and rivalry.
5. Grievances and complaints of all kinds are minor and infrequent, as employees are too busy attending to their work to be looking for trouble.
6. Sense of pride in work results in lowered waste and spoilage and better care of all company property and equipment.
7. Cost reduction is a natural result of especially harmonious cooperation between labor and management.

The past decade has witnessed great strides in our economy, to new high record levels of production. The further progress to be made in the near and distant future is unlimited and incalculable. At the moment, we are in an era of keen competition—of itself a great impetus for improved performance by the worker who directly shares in his company's profits. There will be some unfavorable deviations in the business curve from time to time. Such occurrences will be occasions for a sort of house cleaning, weeding out of companies without foresighted leadership, and seasoning and strengthening those that are well established with a progressive management of tested and proven ability.

Competent management will not overlook the potential usefulness of a funded profit-sharing plan in the new business world of tomorrow. As a possible source of cash working capital, it can provide considerable assistance to the company through lending uninvested funds. Interest paid on such borrowing, instead of going to the banks, adds income to the earnings of the fund. This directly benefits all participants in the profit-sharing plan.

New capital can be provided for the company by sale of stock to the profit-sharing fund, thus again returning dividends on the company stock as further direct earnings to the fund, for the benefit and encouragement of the profit-sharing employees. Investment in company stock by the profit-sharing fund makes the employees direct part owners of the business they are working for. As they personally, thereby, enjoy the benefit of its further profit distributions in the form of dividends, they will become interested to an even greater degree than before to produce and save, so that both profit-sharing contributions and dividends paid by the company will be greater. It can happen that this stock ownership by the profit-sharing fund will eventually result in majority control

of the business by the fund, thus preventing the passing of ownership to outside financial interests, with possible disadvantage to the employees whose direct efforts provide the return upon the owners' investment in the form of paid dividends and retained profits.

The guaranteed annual wage looms large upon the horizon. In cases in which it is adopted, the supplementary payments making up the difference between earnings on the job and mutually agreed upon guaranteed annual wages, may well be borrowed from the profit-sharing fund as a short-term, guaranteed loan by the company and may even be accumulated by the employees over a specified period of actual work, through their personal contribution account, so that the payroll department may have the extra money available for payment if and when actually required.

In this paper we have not attempted to deal with differences in profit-sharing plans or with specific benefits to employees involved. All of the various forms of profit-sharing have unique features to meet needs of individual companies and employee groups. Our attention has been on the general picture. It is pertinent to suggest a study of the phenomenal growth in the number of applications for new profit sharing plans filed and processed by the Bureau of Internal Revenue during the past five years. According to its figures, there were 21,825 qualified profit sharing and pension plans in operation as of October 31, 1953. The figures also disclose an increase of 3,657 in new plans for the year ending June 30, 1953, as against 2,347 the previous year, with an additional 1,349 plans awaiting approval as of June 30, 1953. Certainly, there could be no better proof that profit-sharing is being widely accepted as a distinctive better business philosophy designed to promote good labor-management relations. In my opinion profit-sharing is destined during the next decade to become, in the fullest sense of the word, the keystone of industrial peace.

An Incentive Plan for Contributory Labor

by CHARLES M. ZUST

Management Consultant, Bayport, N. Y.

The description here of an incentive plan for indirect labor emphasizes the plan's relationship to and dependence on the existence of incentives for direct labor. Implicit in the formula presented and expounded is the necessity for developing and keeping up to date within the company, standard participation percentages of indirect workers in departmental results and standard ratios of indirect to direct workers. The use of the basic formula is illustrated.

SINCE THE VALUE ADDED by the nonproduction worker is spread over many segments of the product simultaneously, direct measurement of it appears complicated. Hence, in almost any organization, indirect or contributory labor has always been a difficult function to remunerate fairly on an incentive basis. In numerous instances, it has, therefore, been a retarding element to the achievement of full production potentials.

Relationship of Contributory to Productive Labor is the Key

The accountant has simplified the task of costing contributory labor through the procedures of overhead application, by stating that any value added by the nonproduction worker is measurable in terms of value added by the production worker. This is the direct labor basis of distribution. However, the relationship between direct and indirect labor costs is completely different for different products and plants. In practically every instance, the remuneration or cost of indirect or contributory labor is treated simply as an item of cost to which regular measurements do not apply, with the result that management is left with the problem of devising ways and means of reducing this expense, on the one hand, and of accelerating the effort of indirect workers, on the other.

The plan described here is one of plantwide application—for large or small companies—as an adjunct or supplement to any direct or production labor incentive plan in operation. The plan represents an endeavor to bring the two types of labor costs and bases of remuneration into closer relationship. It is, incidentally, the first plan of its kind and nature which met with the approval of the Wage Stabilization Board as being constructive, fair and equitable, without being inflationary. In its practical application, this plan is conceived further as one which will attract better workers and will stimulate contributory or indirect labor (such as die setters, internal transportation, crane operators,

plant maintenance, material handling, tool room employees, firemen or porters) to extra effort and extra take-home pay.

In the development stage of the plan, the first consideration was to establish a basis for remunerating contributory employees for effort beyond normal, in a way which would be fair to all concerned, as well as in proper relation to the income earned by direct or productive workers, whose efforts and output are accurately measurable, and whose incentive earnings are definitely distinguishable under any up-to-date wage incentive plan.

The Formula and the Factors

The fundamentals of the plan for contributory workers' incentive earnings are considered in the following equation:

$$F = X\ (B - M)\ f$$

This can be expanded to indicate the nature of the symbols, as follows: F (distributable fund) = X (standard participation factor) times [B (direct labor bonus) minus M (direct labor make-up pay)] times f (standard ratio of indirect to direct personnel). The factors involved are defined in this and immediately succeeding paragraphs. The Fund (F) is of primary importance. Before any incentive earnings can be paid to the nonproduction workers or contributory labor, there must be a fund established from which this money can be distributed. The plan outlined here stipulates that the total fund for this purpose is determined by the incentive earnings of the production workers. However, the production workers can only earn bonus by the steady, constant, and continuous application of effort, whereas the effort necessary by contributory labor, such as crane operators, truckers, etc., is neither continuous nor constant. Therefore, the fund is subject to modifications, as will be developed.

First among the determining factors of the work fund is the Participation Factor (X), which denotes the degree of effort required by contributory labor to serve the production workers effectively and is expressed as a percentage. This factor becomes standardized within an enterprise for each of the various conditions encountered. It remains fixed until such time as the contributory labor makeup changes basically, when the factor requires adjustment, just as production standards are subject to review when basic changes are made in job condition.

Tables are available for establishing the participation factor, but they must be used with discretion since it will vary for the same job classification from plant to plant and even from department to department. For example, the participation factor for crane operators has been found to vary from 40 per

PRODUCTIVE AND CONTRIBUTORY WORKER CLASSIFICATION

BY PLANT DEPARTMENTS

As of _____ (day shift only)

DEPARTMENT	PRODUCTIVE EMPLOYEES	CONTRIBUTORY EMPLOYEES	CONTRIBUTORY CLASSIFICATION	GROUP CODE
Productive Departments				
Shear	11	3	Set-up men	(2)
			Nonworking leadmen	(1)
Press	45	8	Set-up men	(5)
			Nonworking leadmen	(2)
			Die-crib attendant	(1)
Brake	22	3	Set-up men	(3)
Welding	56	0		
Paint	40	3	Nonworking leadmen	(1)
			Washer attendant	(1)
			Mixing room attendant	(1)
Assembly	56	1	Stock attendant	(1)
Shipping	36	0	-	
Service welding	13	0	-	
Service assembly	16	0	-	
Service	52	2	Set-up men	(1)
			Material handler	(1)
Plating	1	0	-	
Contributory Departments				
Tool room	-	12	Tool and die makers	(12)
Sample	-	5	Jig makers	(2)
			Repairmen	(3)
Material control	-	9	Leadmen	(3)
			Laborers	(6)
Transportation	-	26	Crane operators	(4)
			Fork lift operators	(5)
			Riggers	(4)
			Working leadmen	(3)
			Laborers	(10)
Maintenance	-	45	Repairmen	(3)
			Machinist	(1)
			Pipefitters	(4)
			Electricians	(4)
			Welders	(2)
			Carpenters	(2)
			Masons	(1)
			Helpers	(8)
			Watchmen	(5)
			Firemen	(4)
			Porters	(6)
			Laborers	(5)

EXHIBIT 1

cent to 90 per cent and for truckers from 60 per cent to 85 per cent. The pertinent point about the participation factor is that it can be negotiated judiciously with indirect department supervisors and its use tends to bring about interest, cooperation, and harmonious relations between contributory labor and the employer.

The Bonus (B) used in the formula for the establishment of the fund is derived from the amount of the incentive bonus paid to the production workers periodically. It determines the maximum amount of incentive wages which can be earned by contributory labor. Thus, it will be seen that the contributory labor bonus is always proportional to the incentive wages of the production workers and the two remain in proper balance.

Makeup Wages (M) under the plan, a subtraction from bonus in the operation of the formula, are considered to be wages paid to the production workers while on incentive production work, to bring their earnings up to the guaranteed base rate. Since these wages are really production losses or money paid for product never produced, and are a measure of the loss of production as between actual and standard, they are not part of the total incentive earnings of the production workers. Hence, the bonus available for distribution is modified by the makeup wages as a further consideration in keeping the bonus earnings of contributory labor in balance with the true incentive earnings of the production workers.

The Contributory Factor (f) completes the formula. It is the ratio of the contributory workers to the production workers and varies with the type of work and the working conditions surrounding the production workers, as well as those affecting the contributory labor serving the area. This ratio also becomes standardized within an enterprise for each of the various conditions encountered and remains fixed until such time as conditions affecting the relationship of contributory and production workers change radically.

The contributory factor can also be adjusted through consultation between management and labor, since on one hand, contributory labor is concerned with avoiding an excess number of workers with consequently too little bonus for each, or too few workers with an excess amount of work, while, on the other hand, management is concerned to avoid situations involving either excess labor and high costs or too little labor with poor service to the production workers and consequent limited production. In short, the contributory labor load becomes the concern of both labor and management.

It will also be seen from the relationships involved in the formula, that the controllability of indirect labor expense under conditions of declining produc-

DEVELOPMENT OF STANDARD CONTRIBUTORY FACTOR (f) FOR CONTRIBUTORY GROUPS

Group	No. Workers	Shear	Press	Brake	Welding	Paint	Assembly	Shipping	Welding	Assembly	Service	Plating
DAY SHIFT ONLY												
Prod. Workers	348	11	45	22	56	40	56	36	13	16	52	1
Contributory Workers serving their own departments exclusively	20	100% (3)	100% (8)	100% (3)	- (0)	100% (3)	100% (1)	- (0)	- (0)	- (0)	100% (2)	- (0)
	Factor f	.272	.178	.136	-	.075	.018	-	-	-	.039	-
Transportation	26	9% (2.34)	25% (6.50)	20% (5.20)	28% (7.28)	1% (.26)	11% (2.76)	1% (.26)	1% (.26)	1% (.26)	2% (.52)	1% (.26)
	Factor f	.212	.145	.236	.130	.007	.049	.007	.020	.016	.010	.260
NIGHT SHIFT ONLY												
Prod. Workers	44	15	11	4	9	0	2	0	1	0	2	0
Contributory workers serving their own departments exclusively	12	100% (3)	100% (1)	- (0)	- (0)	100% (6)	- (0)	- (0)	- (0)	- (0)	- (0)	- (0)
	Factor f	.200	.091	-	-	.200	-	-	-	-	-	-
Transportation	5	41% (2.05)	36% (1.90)	6% (.30)	8% (.40)	- (-)	3% (.15)	- (-)	2% (.10)	- (-)	2% (.10)	- (-)
	Factor f	.137	.173	.075	.045	-	.075	-	.100	-	.050	-
COMBINED SHIFTS												
Prod. Workers	392	26	56	26	65	40	58	36	14	16	54	1
		-	70%	9%	-	-	-	-	-	-	21%	-
Tool Room	12	-	(8.40)	(1.10)	-	-	-	-	-	-	(2.50)	-
	Factor f	-	.150	.042	-	-	-	-	-	-	.046	-
Fixtures and Repairs	5	15% (.75)	20% (1.00)	15% (.75)	12% (.60)	-	38% (1.90)	-	-	-	-	-
	Factor f	.029	.018	.029	.009	-	.033	-	-	-	-	-
Material Control	9	Because of widespread coverage, evenly distributed over all 100% for entire plant activity, material control fund is established on the basis of productive workers in entire plant, both shifts (9) employees .023										
Transportation Maintenance	46	Because of widespread coverage, and uncontrolled variation, 100% for entire plant maintenance fund is established on the basis of productive (46) employees workers in entire plant, both shifts. 117										

EXHIBIT 2

tion volume is increased through the use of this bonus plan, inasmuch as a reduction in the number of productive workers will cause a drop in the amount of bonus earnings of contributory workers. This, in turn, stimulates action on the part of the supervisors of indirect departments to reduce the indirect force, so as to increase the bonus earnings of the remaining employees.

Distribution of the fund determined by the formula which has been described, is made to each individual involved, in the relationship which his base rate

DISTRIBUTION OF CONTRIBUTORY WEEKLY BONUS FUND

Contributory Workers Serving Their Own Departments Exclusively

$$\text{Bonus for each} = \frac{\text{Fund for group from their department}}{\text{Total straight time gross earnings for group}} \times \text{The individual's straight time gross earnings}$$

Contributory Workers Serving More Than One Department

$$\text{Bonus for each} = \frac{\text{Sum of funds for group from various departments served}}{\text{Total straight time gross earnings for group}} \times \text{the individual's straight time gross earnings}$$

Note: Straight time earnings equal base rate (plus shift differential, if appropriate) times total actual hours worked.

EXHIBIT 3

earnings bear to the total base rate earnings of his contributory labor group during the payroll period. Therefore, it will be seen that the individual shares in the bonus directly in accordance with the effort expended.

Developing the Factors

To illustrate the operation of this indirect labor bonus plan, Exhibits 1 to 4 are presented as exemplifying a step-by-step development of the bonus factors and amounts, drawn from an actual installation. Exhibit 1 is tabulation of productive and contributory worker classifications by plant departments for the day shift and night shift, respectively. Exhibit 2 includes a tabulation of the percentages of contributory activity (for Factor X) devoted to each department and a schedule of standard contributory factors, (Factor f), respectively. The numbers in parentheses represent the number of contributory workers taken from Exhibit 1 for the day or night shift. The activity percentages of group classifications relative to operating departments used in this example, are somewhat empirical and are subject to special study in each case. They should, therefore, be accepted at this point for illustrative purposes only. As stated earlier, the relationships in actual practice, once established, remain constant until conditions are changed.

Exhibit 3 gives an explanation of the distribution of the weekly bonus fund

SAMPLE COMPUTATIONS OF BONUS PAYABLE

Contributory Workers Serving One Department Exclusively

To find bonus for day-shift contributory workers for Shear Department

Bonus for Shear (B) = $ 300.00
Make-up for Shear (M) = 60.00
f for these men = .272 (see Exhibit 2)
Fund = 0.5 x (300.00 - 60.00) x .272 = $ 32.64

John Doe straight time gross earnings = $55.00
John Smith straight time gross earnings = 43.00
Bill Brown straight time gross earnings = 60.00
$158.00

John Doe Bonus = $\frac{32.64}{158.00}$ x 55.00 = $ 11.36

John Smith Bonus = $\frac{32.64}{158.00}$ x 43.00 = $ 6.88

Bill Brown Bonus = $\frac{32.64}{158.00}$ x 60.00 = $ 12.40

Note: Straight time earnings equal base rate (plus shift differential, if appropriate) times total actual hours worked.

Contributory Workers Serving More Than One Department

To find bonus for Tool Room Workers (see Exhibit 2) contributing to press, brake, and service

	X	B-M	f	FUND
Press	0.50	$ 300.00	0.150	$ 22.50
Brake	0.50	100.00	0.042	2.10
Service	0.50	150.00	0.046	3.45
				$ 28.05

Total straight time gross earnings for Tool Room was $ 960.00

Henry Doe straight time earnings were $ 80.00

Henry Doe Bonus = $\frac{28.05}{960.00}$ x 80.00 = $ 2.33

EXHIBIT 4

for contributory workers assigned exclusively to one department, as well as to groups of contributory workers assigned to two or more departments.

Exhibit 4 supplies an example of calculation, showing how the bonus participation for contributory workers serving one department and for workers

serving more than one department, is established. In the case of contributory workers serving more than one department, of course, departmental bonus participation will be added up into a total bonus fund and distributed weekly to each participating individual upon a scale of actual hours worked and individual base rates, respectively.

From these detailed data from an actual installation the reader can visualize the operation of the plan. Two matters may require a further word of explanation. The first is grouping, to which reference has been made. This is the segregation of the contributory labor into units whose work load consists of serving a given production area and is totally measurable by the output of the production workers within that area. In other words, work centers for contributory labor vary with the work. The work-load of a die setter or crane operator assigned to one department only would be measurable by the output of the production workers within that department, whereas the work load and bonus earnings of a class of contributory labor serving throughout the plant would be measurable on a plant-wide basis, as is the case with maintenance, material transportation, etc., or in a limited sense, toolmaking.

The second matter is coding. The method of timekeeping or payroll operation is unimportant under the plan. However, it is made easy by simplified coding. It is necessary to know the contributory labor group to which the individual is assigned and the corresponding group of production workers from which the incentive earnings are determined. In other words, the payroll is set up in the order which will best facilitate the making of bonus calculations.

Advantages Which May Be Expected

Reactions to the plan in practical application have pointed to improved labor relations and indicate that the following advantages are inherent in it:

1. **Bonus earnings can be calculated and checked by the worker.**
2. **Bonuses can be paid weekly or over any period.**
3. **Changes in costing or accounting procedures are not needed.**
4. **Payroll calculations are simple and can be made part of the regular payroll routine.**
5. **Installations can be made departmentally or on a plant-wide basis.**
6. **Contributory labor groups tend to police themselves, to guard against unnecessary additions to the group, and against resulting lower bonus earnings.**
7. **Contributory labor strives to improve its services to obtain increased production, greater incentive earnings for the production worker, and larger bonuses for itself.**
8. **Contributory labor discourages the need for makeup wages.**

The incentive plan for contributory labor should, of course, be tailored to fit the work-pattern of a particular plant, to make the results fair, practical and constructive for everyone involved.

THE COST FORUM

ANNUAL MILEAGE MAY DETERMINE WHETHER TO LEASE OR OWN AUTOS

Editor, N.A.C.A. Bulletin:

I WAS VERY MUCH INTERESTED in I. Wayne Keller's article published in the *N.A.C.A. Bulletin* last fall and entitled "Shall We Lease or Buy Equipment?" particularly the section devoted to leasing automobiles. Our company has maintained a fleet of several hundred leased automobiles for the past several years. I believe that N.A.C.A. members will be interested in our cost comparisons and experiences. We do not maintain a company-owned fleet of automobiles. Employees who drive on company business are supplied with a leased automobile if they can show that they expect to drive at least 20,000 company miles per year. Drivers not qualifying for leased automobiles drive their own automobiles and are reimbursed on sliding scale formula rates to compensate them for all incurred costs.

We maintain a continuing study of the new and used automobiles markets and of fixed costs such as insurance, taxes, licenses, etc. From these data we compile estimated cost of company ownership. The estimated costs are compared periodically with the total leased car costs on a cost-per-company-mile basis. Adjustments are made to allow for interest on investment. Our primary concern is to secure the necessary transportation for our salesmen at the lowest cost. We do not rely wholly on our own cost estimates on company ownership but check our figures also with A.A.A. studies, Dartnell findings, and other similarly reliable sources.

Our studies have proved beyond a doubt that it is more economical to lease automobiles than to own them when the fleet average is 20,000 or more company miles per year. On the other hand, should we allow our fleet average to drop below the 20,000 mile figure, the cost figures become more and more favorable to company ownership as the average mileage declines. Below 10,000 miles per year, we find that it is more to our advantage to have the employee own his automobile and be reimbursed for the company miles driven.

The present downward trend in used car values, particularly the late models, with no compensating reduction in new car prices, has noticeably lowered the net return to automobile leasing companies. This is causing most of these companies to start asking for or thinking about higher rental rates. At first glance this situation would appear to influence the comparative costs as between leasing and owning, in favor of ownership, regardless of the company miles driven. However, our latest cost comparisons (as of the date of preparing this letter) completed the first week in December 1953 and using average November used car market prices, still favor the leased fleet in our case, even after allowing for the maximum rental increase we might have to face in the near future. Company owned fleets of automobiles suffer the increased depreciation costs as the margin of value widens between new and used automobiles, thus adding considerably to the overall costs of fleet ownership.

In addition to the foregoing considerations, we have found that there are certain other advantages in leasing rather than owning our fleet. No sales time is wasted while an employee bargains for a new car

at time of replacement. There is very little lost time and trouble to the employee if the automobile is wrecked or stolen or destroyed by fire, as the leasing companies make prompt replacement and handle the insurance details. Very little time is lost by the employee due to having the automobile in the garage for repairs. The employee is better satisfied when he gets a new automobile every year and can present a good appearance to his customers, as well as know that he has reliable transportation.

These comments are not to be considered as recommendation for a leased fleet of automobiles on an unqualified basis. Rather they are to be considered as supplementing Mr. Keller's article and to confirm his statement that "the results of our studies of the cost of leasing our automobiles should not be taken to mean that there is usually no cost advantage in leasing." We want to point out definitely that our cost situation, favoring leased automobiles, results primarily from a relatively high average of anual company miles sustained year-in and year-out. We cannot recommend a leased fleet from a purely cost saving angle, unless a fleet average of 20,000 or more annual company miles can be maintained.

EDWARD J. O'CONNOR, *Akron Chapter*

SURVEYING AND REPORTING ON THE HIDDEN COST OF SENIORITY RIGHTS

Editor, N.A.C.A. Bulletin:

One of the hidden but very real costs of manufacturing is the cost of carrying out the provisions for seniority as required by many labor agreements. An agreement often contains many of these provisions but the principal ones, from a cost standpoint, are those which deal with seniority as the basis for the movement of employees in relationship to promotions, job preference and layoffs. Many times the effect of one of these moves is to cause the foreman to lose time by canvassing the department to fill a vacancy, posting the job for promotion, and training a new employee. Labor costs are increased when the old employee remains on his job to instruct a new man who was placed according to seniority. In some cases, these costs will pyramid many times in replacing a single employee on a highly-paid job, because of the series of promotional moves which have to be made in the lower-rated jobs. Then, too, production is often lost and defective work increased due to inexperienced employees who bid into their jobs on the basis of seniority.

It is of course impossible, at any given time, to produce total cost of seniority from the regular payroll and costs records. However, a reasonably accurate estimate can be obtained by making a survey for a period of several months of the cost of individual factors resulting from movement of personnel from one job to another. As the foremen are the key men, it is first necessary, in the survey, to acquaint them fully with the significance and potential cost of the many seniority factors which they may otherwise overlook. Then, the foremen are requested to submit daily reports showing such information as foremen's lost time, employees' lost time, decreased production as well as excessive defective work—all of which can be attributed to movement of personnel.

In preparing these reports, the foremen measure decreased production as the difference between the standard number of units which could be produced by competent employees and the quantity actually produced by unqualified employees who bid into their jobs on the basis of seniority. In the same way, excessive defective work is considered as the difference between the number of defective units actually produced under seniority conditions and the standard or normal spoilage.

The foremen's daily reports on this subject are appropriately routed to the cost department. Here, after the labor hours are priced at the prevailing rates and the production and defective work are extended at the established cost, the reports can be summarized to compile the total cost of seniority during the period of the survey. From this, the average seniority cost per day, per month, and per year can be developed and reported to management. Although these reports will not be exact and can be considered merely as estimates, they will nevertheless supply valuable information to management which would not ordinarily be obtained.

The key to this approach is recognition that the lowest-level foreman can make better estimates of this type of cost than anyone else. By getting detailed estimates from a number of such foremen, figures may be compiled for a whole plant.

ROBERT H. STRAYER, *Pittsburgh Chapter*

COMPUTING RETURN ON INVESTMENT TO AID IN PRICING

Editor, N.A.C.A. Bulletin:

THE TOPICS OF HOW COSTS are used in setting selling prices is always a popular discussion theme. The role of the cost accountant is certainly that of supplying the cost information used, in conjunction with other factors, to arrive at a selling price. However, the accountant's function extends beyond cost reporting and includes a responsibility for investment figures. He should have at his disposal figures which indicate how much investment—working capital and permanent—is associated with each operation and/or product. This important phase of the accountant's part in selling price studies is too frequently overlooked. It seems illogical, for example, for a price to be calculated without knowledge of the return on investment it is expected to yield.

Much has been written on procedures used for accumulation of costs and their proper allocation to operations and products. Overhead, in particular, has been the subject of considerable discussion as to effects and consequences of using different distribution bases. It is continually stressed that, for a firm to operate profitably, costs of all products must be covered by their selling prices. However, when it comes to allocation of investment to various products and computation of return being earned by each, there is a paucity of information of what procedures can be used and how various systems have been set up to yield this type of data.

Basically, funds are invested in an enterprise for the purpose of securing a return on investment in excess of what could be received elsewhere. The return being realized may be computed by relating total earnings to total capital. However, the return so computed will be an average figure and, unless investment is broken down to operations, and for products, it will not be known whether each segment of the funds being used is yielding a satisfactory return. Similarly, in establishing selling prices, it would appear fundamental that the price being set for each line or product should be expected to return the normal rate on the capital to be employed. This, of course, necessitates knowing what and how much the investment in each operation and product amounts to.

Investment used by operations consists of working and permanent capital. Working capital includes raw materials, accounts receivable, cash, etc. All items classified as current assets. Permanent capital is made up of direct investment in facilities used and also allocated investment from general facilities, such as the power house, office building, etc. As in allocating overhead, there are many difficulties which arise in

distributing investment to operations and products.

Definite bases must be established, for example, in allocating raw material investment when more than one operation uses the same ingredient. Analysis of sales has to be made in determining the distribution of accounts receivable. Usually cash is the largest item of working capital and the most difficult to allocate. Cash is required to meet labor costs associated with an operation and to purchase necessary ingredients. Therefore, a simplified method of calculating cash required is to consider estimated cost of a month's production, less any noncash items such as depreciation, as being the cash tied up as working capital for an operation.

Direct permanent investment does not present many difficulties. However, the determination of how much of a permanent general or service facility to allocate to a product is something different. How investment in a power plant may be distributed will indicate a typical solution. The end products of a power plant are steam, electricity and air. After computing total investment in power facilities, the total is redistributed into steam, electricity and air investments. These investment figures are then allocated to the various operations in accordance with the amount of steam, electricity and air used during the period. Similar bases have to be used in allocating other general facilities. Labor costs and direct investments are representative bases used. At the end of each period, total investment associated with every product is calculated and, when the earnings from the product are related to investment, the rate of return is known. This, of course, assumes that in a multi-product firm, costs and revenues are detailed by products.

This break-down of investment—both current and permanent—is extremely useful for many purposes, especially in price analysis work. In setting selling prices, for example, investment per unit may be computed by dividing total determined product investment by practical output expected. With cost and investment per unit available, it is possible to determine what return on investment can be expected at various prices and at existing Federal tax rates. The accountant, in providing this type of investment information, is fulfilling his responsibility much more adequately than if all he does is deal with cost figures. Accounting for investment and calculation of unit investment figures, is as much the cost accountant's job as is accounting for total and unit costs.

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